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The extension of the scope of the National Museum during the past few years, and the activity of the collectors employed in its interest, have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man.

The importance to science of prompt publication of descriptions of this material led to the establishment, in 1878, of the present series of publications, entitled "Proceedings of the United States National Museum," the distinguishing peculiarity of which is that the articles are published in signatures as soon as matter sufficient to fill sixteen pages has been obtained and printed. The date of publication being plainly expressed in each signature, the ready settlement of questions of priority is assured.

The articles in this series consist: First, of papers prepared by the scientific corps of the National Museum; secondly, of papers by others, founded upon the collections in the National Museum; and, finally, of interesting facts and memoranda from the correspondence of the Smithsonian Institution.

The Bulletins of the National Museum, the publication of which was commenced in 1875, consist of elaborate papers (monographs of families of animals, &c.), while the present series contemplates the prompt publication of freshly acquired facts relating to biology, anthropology, and geology; descriptions of restricted groups of animals and plants; the settlement of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

The Bulletins and Proceedings are published by the authority and at the expense of the Interior Department, and under the direction of the Smithsonian Institution.

The present volume, constituting the eighth of the series, has been prepared under the editorial supervision of Dr. Tarleton H. Bean, curator of the department of fishes.

SPENCER F. BAIRD,
Director of the U. S. National Museum.

UNITED STATES NATIONAL MUSEUM,
Washington, April 29, 1886.

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Page 17, line 23, change grunnieus to grunniens.
Page 27, line 9, change Nationa to National.
Page 38, line 2, before stand insert should.
Page 59, line 29, change *Exocætes* to *Exocœtus*, and 392 to 397.
Page 72, line 2 from below, change *Lepiogobius* to *Lepidogobius*.
Page 99, line 18, change *æstivais* to *æstivalis*.
Page 99, line 22, change *Peucœa* to *Peucæa*.
Page 113, line 16, change Scolapacidæ to Scolopacidæ.
Page 122, line 8, change Pognichthys to Pogonichthys.
Page 128, line 16, change Ebiotocoids to Embiotocoids.
Page 164, line 1, change *Beleosoma* to *Boleosoma*.
Page 241, line 24, change Cones to Coues.
Page 245, line 26, change MeKenzie to McKenzie.
Page 246, line 2, change Sterns to Stearns.
Page 252, line 13, change Sterns to Stearns.
Page 258, line 15, change *nutalliana* to *nuttalliana*.
Page 260, line 20, change *Bulimuls* to *Bulimulus*.
Page 268, line 19, change Helx to Helix.
Page 269, line 26, change *Hetix* to *Helix*.
Page 287, line 24, change *Blanneria* to *Blauneria*.
Page 355, line 3 from below, change *Bernida* to *Bernicla*.
Page 381, line 6, change Appogonidæ to Apogonidæ.
Page 387, line 29, change 534 to 334.
Page 389, line 6, change Opistognathus to Opisthognathus.
Page 596, line 6, change *atronasus* to *occa*.
Page 601, line 9, change single to bifid.
Page 682, Fig. 4 is inverted.

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LIST OF FISHES COLLECTED IN IOWA AND MISSOURI IN AUGUST, 1884, WITH DESCRIPTIONS OF THREE NEW SPECIES.

By DAVID S. JORDAN and SETH E. MEEK.

During the months of July, August, and September, 1884, a series of explorations of the streams of the south and southwest was undertaken under the direction of the United States National Museum and the United States Fish Commission by Professor Jordan, assisted by Prof. Charles H. Gilbert, Prof. Joseph Swain, and Mr. Seth E. Meek. The present paper is the first of a series intended to place on record the result of these explorations. It includes the streams examined by the present writers, namely, the Des Moines, the Chariton, the Hundred and Two, the Missouri, and several tributaries of the La Mine and the Osage. Nearly all the specimens mentioned were obtained with a fine-meshed seine of large size. These are now in the United States National Museum, with the exception of series retained for the Indiana University and the Academy of Natural Sciences at Philadelphia.

A.—*Des Moines River at Ottumwa, Iowa.*

Most of the streams of Southern Iowa are muddy and excessively sluggish, and they become nearly dry in summer. The Des Moines is, however, exceptional in these respects. Its waters are comparatively clear, and at Ottumwa it flows with considerable current. Its bottom is in part hard clay, with some rocks, but at the mouths of tributaries and where the current slackens, it is covered with soft black mud. Our collections here were made opposite the city on the right bank of the river. A number of specimens were taken from a muddy slough, and still others from a brook called Village Creek southwest of the city. In August this is a small stream of clear water flowing over muddy sand.

1. **Noturus flavus**, Rafinesque.

One taken in the river.

2. **Amiurus nebulosus**, Le Sueur.

Anal rays 22.

3. **Ictalurus punctatus**, Rafinesque.

Very common in the river channel; also in the bayou.

4. **Ictiobus velifer**, Rafinesque.

Common in the river.

Bluish silvery above, silvery below, with darker streaks along the rows of scales. Paired fins red; other fins pale olive. Mouth small, the snout projecting much beyond it. Longest dorsal rays reaching nearly to end of fin in adult, rather shorter in the young; D. 26. Scales, 7–37–5. Head, 4 in length; depth, 3.

No one has yet obtained sufficient material for the thorough study of the Buffalo fishes. At present we regard the group called *Carpiodes* as containing three distinct species. *I. cyprinus*, Le Sueur, found only east of the mountains, and characterized by the nearly smooth, scarcely striate opercle, and by the small size of the eye. *I. carpio*, distinguished by the elongate form, short head and low dorsal fin, and *I. velifer* having the general form of *I. cyprinus* and a strongly striate opercle like *I. carpio*.

Among the specimens referred to *I. velifer*, we find much difference in the form of the body, the size of the head, the position of the mouth, the size of the eye, and in the height of the dorsal fin. We find individuals corresponding more or less perfectly to the descriptions or the typical examples of *I. tumidus*, *damalis*, *grayi*, *thompsoni*, *bison*, *velifer*, *selene*, *cutisanserinus*, and *difformis*, as well as others apparently in all degrees intermediate. Either all constitute one polymorphous species, or else we have as yet failed to separate individual from specific characters, and the latter still remain to be detected. Generally no doubt exists in regard to *I. carpio* (=*nummifer*, Cope), and *I. cyprinus* (=*vacca*, Agassiz), but puzzling and variant specimens of these are occasionally found.

5. **Moxostoma macrolepidotum duquesnei**, Le Sueur.

Common in the river. D. 12 to 14.

6. **Campostoma anomalum**, Rafinesque.

But one specimen seen—in Village Creek.

7. **Hybognathus nuchalis**, Agassiz.

A specimen agreeing entirely with the ordinary *nuchalis* type, but much darker in color.

In life, light green, silvery below, with dark punctulations. A black vertebral streak and a rather distinct dusky lateral band, not ending in a spot at base of caudal. Caudal yellowish.

8. **Pimephales promelas**, Rafinesque.

(*Coliscus parietalis*, Cope, Hayden's Geol. Survey Wyo., 1872, 437.)

Many specimens taken in Village Creek and in the bayous. These agree fully with Cope's description of *Coliscus parietalis*, and differ considerably in appearance from the adult of *Pimephales promelas*. On comparison of our specimens with large series of the latter species we find what appears to be a complete gradation, and we have no doubt that *Coliscus* is simply the immature form of *Pimephales*.

In life, light green above, the scales edged with darker; a plumbeous band formed of dark points along the side, ending in a faint spot at base of caudal; a dusky dorsal streak; a dark dash on upper part of opercle. Fins plain, the caudal a little yellowish, with some dark points.

Body more elongate than in the adult *Pimephales*, the head less deep. Caudal peduncle very long. Fins small. Scales small, crowded above; lateral line appearing on some 5 to 15 scales. Dorsal fin inserted above ventrals.

Head $4\frac{1}{6}$; depth $4\frac{5}{6}$. Scales 43. Teeth 4–4, scarcely hooked. Intestines long. Peritoneum black. Mouth small, oblique, as in *Pimephales*.

9. **Pimephales notatus**, Rafinesque.

Common.

10. **Cliola vigilax**, Baird and Girard.

(*Ceratichthys vigilax*, Baird and Girard, Proc. Ac. Nat. Sci., Phila., 1853, 390.
Cliola velox, Girard, l. c., 1856, 192.
Cliola vivax, Girard, l. c., 1856, 192.
Hybopsis tuditanus, Cope, Trans. Amer. Phil. Soc., Phila., 1866, 381.
Alburnops taurocephalus, Hay, Proc. U. S. Nat. Mus., 1880, 503.
Hypargyrus tuditanus, Gilbert, Proc. U. S. Nat. Mus., 1884, 200.)

Examination of a very large series of specimens of this widely distributed and very abundant species in the National Museum leaves no doubt that all the above names refer to a single species. Among these are the types of *Cliola vivax* and *Alburnops taurocephalus*, as well as that of Professor Gilbert's description above cited. As this species is the original type of the genus *Cliola*, that name becomes equivalent to *Hypargyrus*, Forbes, and must be used for this group if its separation from *Notropis* be approved. Our specimens agree well with Gilbert's description.

In life, light green above, the scales slightly edged with darker; a distinct plumbeous lateral band, narrower than in *Pimephales notatus;* a distinct round black spot at base of caudal. Belly silvery. Fins mostly creamy, the dorsal with a sharply-defined black spot in front, surrounded by yellowish.

As already noticed, this species bears much resemblance to *Pimephales notatus*. It has, however, a more terminal mouth, with the gape slightly oblique. Its coloration is paler, with the dark markings, es-

pecially the dorsal spot, much more sharply defined, less blended with the surrounding coloration.

Common in the river.

11. Notropis deliciosus, Girard.

(*Moniana deliciosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 199.
Hybopsis missuriensis, Cope, Hayden's Geol. Surv. Wyo., 1872, 437.)

Rather common in the river.

Our specimens are undoubtedly identical with *Hybopsis missuriensis*, Cope. We have lately found the types of *Moniana deliciosa*, Girard. These have 35 or 36 scales in the lateral line, and we are unable to distinguish them from *H. missuriensis*. The latter in turn agrees fully with *H. stramineus*, Cope, except that in the latter (found east of the Mississippi River) the scales are rather smaller in size.

Seven specimens from White River, Indiana (*stramineus*), show the following numbers of scales: 34, 36, 36, 37, 37, 38, 38. Two from Cumberland River (*deliciosus*), 34, 34. Eleven from Des Moines River (*deliciosus*), 32, 32, 33, 33, 33, 33, 33, 34, 34, 35, 35. We regard, then, *stramineus* as a scarcely tangible variety of *deliciosus*. *Hybopsis longiceps*, Cope, and *H. volucellus*, Cope, are probably also varieties of the same species. *Minnilus microstomus*, Rafinesque, may be the same as *longiceps* or *stramineus*, but it is too briefly described to justify us in using the name.

Our specimens of *N. deliciosus* vary somewhat in color, some being in life very pale green, silvery below, with traces only of a vertebral streak, and no dark punctulations along the lateral line. Others are darker, the scales dark-edged, a strong dark vertebral line, and numerous dark points along the sides of the body and of the snout. Fins pale.

12. Notropis gilberti, sp. nov.

(? *Alburnus lineolatus*, Agassiz, Bull. Mus. Comp. Zool. 1863, 9; ? *Leuciscus lineolatus*, Günther, vii, 260; ?? *Hybopsis scylla*, Cope, Hayden's Geol. Surv. Wyo., 1872, 438.)

Common in Village Creek; not seen in the river.

As this species was later found in abundance in tributaries of the Osage River, the original locality of the *Alburnus lineolatus* of Agassiz, we have tried to identify our specimens with the latter species, although the original description is of very little value.

Hybopsis scylla, Cope, is perhaps the same species, but the description is not very satisfactory. As, however, both *lineolatus* and *scylla* are said to have the teeth 4–4, we have deemed it safest to apply a new name to our species.

Color, greenish above, paler below; the sides with numerous dark points, which form an obscure dusky lateral band, which ends in a faint spot; a dusky dorsal streak; top of head dusky; fins, soiled whitish.

Form more elongate than that of *N. deliciosus*, with longer, slenderer head, longer and more contracted caudal peduncle. Head long and low, flattish above and rather broad. Snout moderately decurved; $3\frac{3}{4}$ in head. Mouth rather large, nearly horizontal, the maxillary extending

to beyond the front of the eye, its length $3\frac{3}{5}$ in head. Lower jaw included, little shorter than upper. Eye small, smaller than in *N. deliciosus*, 4 in head; its length scarcely greater than interorbital width.

Scales rather smaller than in *N. deliciosus;* those in front of dorsal somewhat reduced, about 17 in number. Lateral line somewhat decurved. Breast naked, or nearly so.

Dorsal fin rather high, its longest rays $1\frac{1}{6}$ in head, its insertion slightly behind base of ventrals, near middle of length of body. Caudal peduncle slightly longer than head. Pectoral moderate, not reaching ventrals.

Head 4 in length; depth, 5. D. 8; A. 9. Scales, 5–34 to 36–4. Teeth, 1, 4–4, 1. Length, about $2\frac{1}{2}$ inches.

13. **Notropis whipplei,** Girard.

(*Cyprinella whipplei*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 198.
Cyprinella analostana, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 38.)

Exceedingly common in the river channels. The lower fins in the males are of a bright creamy yellow.

On comparison of specimens of *N. analostanus* from various regions with specimens of *N. whipplei*, among them Girard's original types, we are unable to detect any differences, except that in the Arkansas examples (*whipplei*) the body is rather more elongate.

14. **Notropis megalops,** Rafinesque.

(*Cyprinus megalops*, Rafinesque, Amer. Monthly Mag., 1817, 120=*Cyprinus cornutus*, Mitchill, Amer. Monthly Mag., 1818, 324.)

A single specimen taken in Village Creek.

It seems necessary to adopt Rafinesque's name for this species, as it is earlier than that given by Mitchill. His description applies very well to *N. cornutus*, and in his manuscript note-books we find his original drawings and notes, which render the identification almost certain.

15. **Notropis boops,** Gilbert. (?)

Two small specimens were obtained, which we are unable certainly to identify at present.

Color, pale green, silvery below; fins, pale; no distinct markings. Eye large; mouth short, oblique, the lower jaw projecting. Scales, about 40. A, 8; teeth, 2, 4–4, 1. They belong, perhaps, to *Notropis boops.*

16. **Notropis rubrifrons,** Cope.

(*Alburnus rubrifrons*, Cope, Proc. Acad. Nat. Sci. Phila., 1865, 85.
Alburnellus percobromus, Cope, Hayden's Geol. Surv. Wyo., 1870, 440.)

Rather scarce, in the river channel.

These specimens and others obtained farther west appear to represent Cope's *percobromus.* We cannot, however, separate it from *N. rubrifrons.*

Color, light green in life, silvery below, with reddish lateral and vertebral streaks; head, reddish above; fins, pale; the base of dorsal red-

dish; upper lip dusky; scales little edged with darker; base of caudal a little dusky. Head, 4; depth, 5½; scales, 6½–38–4.

17. Phenacobius mirabilis, Girard.

(*Exoglossum mirabile*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 191.
Sarcidium scopiferum, Cope, Hayden's Rept. Geol. Surv. Wyo., 1872, 440.
Phenacobius teretulus liosternus, Nelson, Bull. Ills. Lab. Nat. Hist., 1, 1876, 46.)

Rather scarce, in the river.

Very pale greenish, silvery below; a silvery lateral stripe, rather distinct; a conspicuous black spot at base of caudal, smaller than eye; fins, pale. Scales, 7–50–5; head, 4⅓; depth, 4½.

On comparing numerous specimens of *Phenacobius mirabilis* we find two types which we at first took for two distinct species or varieties, but which seem to intergrade fully. One of these (*mirabilis*) has the scales comparatively small and with their outlines blended, not emphasized by dark edgings. The following is the count of the scales: Des Moines River, 49, 50; Illinois River, 50; Fort Smith, Arkansas, 52. Other specimens (*scopifer*) from Illinois, Iowa, Missouri, Arkansas, Texas, &c., have scales larger, with dusky and therefore sharply defined edges; their numbers 43, 43, 44, 44, 44, 45, 45, 45 in eight specimens. There is no other tangible difference, and we refer all to *P. mirabilis.*

18. Hybopsis storerianus, Kirtland.

(*Rutilus storerianus*, Kirtland, Boston Journal Nat. Hist., 1, 71, 1842.
Hybopsis storerianus, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 211.
Ceratichthys lucens, Jordan, Proc. U. S. Nat. Mus., 1879, 238, not
Hybopsis storerianus, Cope, *Leuciscus storerianus*, Günther, or *Cliola storeriana*, Jordan & Gilbert, which are *Notropis hudsonius amarus.*)

Very abundant in the current of the river; next to *N. whipplei*, the most common fish in the river.

The specimens called *Hybopsis storerianus* by Girard are still preserved in the National Museum. They belong to the species lately described as *Ceratichthys lucens*, and we are now convinced that this is the original *storerianus* of Dr. Kirtland. This species is far more widely distributed and abundant in the West than has been hitherto supposed.

Color in life, light olive above, bright silvery below; scales above with a few dark points along their edges; sides with a bright silvery band, above which is a green-stripe, which is visible in certain shades. Sides with faint golden and bluish shades. Fins pale, the caudal dusky at base, a little milky at tip.

Teeth usually 1, 4–4,0, not 4–4. Barbel very conspicuous. Preorbital bone large, silvery.

19. Hybopsis hyostomus, Gilbert.

A few small specimens found in the river. These agree with Gilbert's original types of *Nocomis hyostomus.* The "black parasitic specks" mentioned by Professor Gilbert are found in all specimens of this species, and are apparently permanent color markings, rather than parasites.

20. **Hybopsis dissimilis**, Kirtland.

Rather rare in the river.

Light green above, irregularly speckled above with darker, some of the scales being wholly or partly dusky; more of these on back of tail; lower parts silvery; a faint plumbeous lateral shade; several dusky roundish blotches on sides of body, the one near base of caudal most distinct; some yellowish behind this and on snout; a blackish area behind nostrils; fins a little yellowish. Maxillary extending to below nostrils. Head, 4 in length; depth, $4\frac{2}{3}$. Scales, 6–42–5.

These specimens are paler in color than is usual in *H. dissimilis*, the body is less slender and the scales are larger. Similar specimens have been taken from White River, Indiana. Examination of a very large series shows some intergradation between these two forms which are probably not distinct species. The case seems to be parallel with that of *Phenacobius mirabilis*.

21. **Hybopsis biguttatus**, Kirtland.

One specimen taken in the river.

22. **Semotilus atromaculatus**, Mitchill.

A few specimens from Village Creek. Scales 60.

23. **Pomoxys annularis**, Rafinesque.

Young very common in the bayous.

24. **Lepomis humilis**, Girard.

Two small specimens.

25. **Lepomis cyanellus**, Rafinesque.

Common.

26. **Micropterus dolomiei**, Lacépède.

Common.

27. **Hadropterus evides**, Jordan and Copeland.

A few in the river channel.

These differ somewhat in coloration from specimens taken in White River, Indiana.

Light clear olive, shaded with light green; sides with rather faint broad green cross-bars about twice as wide as the interspaces, which are light orange, the color deepening to an orange spot on the middle line of the side, on each cross-bar. Some light orange on back of tail and on base of caudal. Cheeks pale, translucent. A distinct, oblique, light yellow [stripe] from below eye, upward and backward across temporal region. A curved green bar behind pectoral. Top of head and snout rusty orange. Lower parts and lower fins pale. Spinous dorsal entirely rusty red, its basal part mostly red, the outer orange; no black spot on dorsal. Soft dorsal and caudal translucent, the latter light orange at base.

Palatines with teeth. Nape scaly; breast naked; cheeks naked; oper-

cles scaly. Head, $3\frac{4}{5}$ in length; depth, $5\frac{1}{2}$. D. XI–12; A. II, 9. Scales, 9–65 to 67–11.

The scales are a little smaller than in Indiana specimens (lat. l. 63), but probably no permanent distinction exists.

28. **Hadropterus phoxocephalus**, Nelson.

Not abundant in the river channel. D. XII–13. Lat. l. 70.

29. **Boleosoma olmstedi maculatum**, Agassiz.

Common in Village Creek.

30. **Ammocrypta clara**, sp. nov.

Allied to *Ammocrypta pellucida*, but with the squamation much less perfect.

Head, $4\frac{1}{8}$; depth, 8. D. XI–10; A. I, 8. Lat. l. 69. Length, $2\frac{1}{4}$ inches. Body elongate, hyaline, subcylindrical, formed as in *A. pellucida*. Head formed as in *A. pellucida*, the snout a little more acute. Mouth subterminal, the upper jaw protractile, the maxillary extending nearly to front of eye, its length $4\frac{1}{4}$ in head. Teeth rudimentary, excessively minute, appreciable along the edge of the jaws only with the lens, none evident on vomer. Eye moderate, $4\frac{1}{4}$ in head, nearly as long as snout and more than double the width of the narrow, grooved, interorbital space. Cheeks and opercles with rather few thin scales imbedded in the skin. Opercular spine well developed. Gill membranes very little connected.

Body naked, except for a strip of scales along the lateral line, consisting of 5 or 6 series of small, imbedded, wide-set, ctenoid scales. On the caudal peduncle this band widens out, covering the whole depth of the tail.

Fins of moderate height, developed about as in *A. pellucida*. Ventrals slightly shorter than pectorals, which are a little shorter than head.

Color in life, translucent, yellowish on top of head. Some dark points on snout, middle of back, and tail; a few along lateral line. Traces of faint orange spots along sides, connected by a lateral streak. Two dark spots, one before the other at base of caudal. Fins all pale.

A few specimens taken in a sandy part of the river opposite Ottumwa. Specimens were also obtained in Red River at Fulton, Arkansas, and in the Sabine River at Longview, Texas.

B.—*Chariton River.*

The Chariton River at Chariton, Iowa, is a narrow, sluggish stream with a muddy or sandy bottom, in summer reduced to a succession of greenish pools of dirty water.

1. **Noturus gyrinus**, Rafinesque.

Young specimens.

2. **Amiurus melas**, Rafinesque.

3. **Catostomus teres**, Mitchill.

4. **Pimephales promelas**, Rafinesque.

Adults brassy olive, the head blackish. Pectoral and caudal dull reddish. Dorsal with a large black spot on the anterior rays. Several young specimens ("*Coliscus*") also taken.

5. **Notropis deliciosus**, Girard.

Common.

6. **Notropis gilberti**, Jordan & Meek.

7. **Notropis lutrensis**, Baird & Girard.

(*Leuciscus lutrensis*, Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 391.
Moniana gibbosa, *pulchella*, *couchi*, *rutila*, and *gracilis*, Girard, l. c. 1856, 199–201.
Hypsilepis iris, Cope, Wheeler's Expl. W. 100th Mer. v, 653, 1876.
Moniana jugalis, Cope, Hayden's Geol. Surv. Wyo., 1872, 439.
Cyprinella forbesi, Jordan, Bull. Ills. State Lab. Nat. Hist. ii, 57, 1878.)

We have examined the typical examples of all the nominal species above enumerated, as well as many other specimens from various streams between Illinois and Mexico. We are unable to point out any permanent distinctive characters whatever among them, and regard all as belonging to a single species. Considerable variation in form is shown in any large series. The types of *gibbosa* and *forbesi* being very deep (depth more than $\frac{1}{3}$ length), while other specimens (especially females) are more elongate (depth $\frac{2}{7}$ to $\frac{1}{4}$ length). Similar variations occur in *Notropis megalops*, *Notropis whipplei*, and other widely diffused species. Of the other species called by Girard "*Moniana*," *deliciosa*, *nitida*, and *proserpina*, seem to be valid species, of the "*stramineus*" type. *Aurata* is close to *lutrensis*, having the head heavier, the mouth more inferior. *Frigida* (=*leonina* and *complanata* probably—these two lost) has rather smaller scales (lat. l. 37) and the body more elongate. *Lætabilis* and *formosa* we are unable to find. The latter is probably a distinct species.

In life, the male of *N. lutrensis* is olivaceous above; edges of scales light clear blue, this color especially distinct in a broad saddle at the nape, which extends downward to the pectoral; this bar of a clear vitriol blue. Behind this and parallel with it is a scarlet area. Opercle scarlet. Front of head crimson. Dorsal fin creamy, shaded with dusky. Other fins light clear blood-red. A slight dusky area at base of caudal. No black blotch on chin (in Iowa specimens; this usually present in Texas examples).

Females are light olive, the fins dull red. Immature examples are variously intermediate. Scales pretty constantly 6–34–3.

8. **Notropis rubrifrons**, Cope.

One male specimen. Silvery; upper part of head, sides of breast, base of dorsal, pectoral, and caudal, bright light brick red. Anal rays 9.

9. **Notropis megalops**, Rafinesque.

10. **Semotilus atromaculatus**, Mitchill.

11. **Lepomis cyanellus**, Rafinesque.

12. **Etheostoma iowæ**, sp. nov.

Three specimens. In life, light green, finely blotched with darker green; a dark-green blotch on opercle; a dark stripe below eye. Lower fins plain. Spinous dorsal shaded with light red, its edge darker red, almost black on the posterior edge. Soft dorsal and caudal barred with green speckles.

Head, $3\frac{5}{6}$; depth, $5\frac{1}{2}$. D. IX–11; A. II, 7. Scales, 5–59–9. Lateral line with tubes on 28 scales. Length, about 2 inches.

Body rather more elongate than in *E. jessiæ* (=*asprigenis*, Forbes), the caudal peduncle rather long and slender. Head moderately acute, the snout a little decurved, its length about equal to that of the eye, which is 5 in head. Mouth small, nearly horizontal, the lower jaw included, the maxillary reaching to opposite front of eye, its length 4 in head. Teeth rather small. Preopercle entire. Opercular spine strong. Gill membranes scarcely connected. No black humeral scale. Cheeks, opercles, and nape closely scaled. Breast naked. Top of head without scales.

Scales smaller than in *E. jessiæ*. Lateral line straight, ceasing near the middle of the body.

Fins all low, the spines slender. Dorsal fins well separated, caudal subtruncate. Pectorals $1\frac{1}{4}$ in head.

This species much resembles *E. jessiæ*, and may prove to be identical with it. Numerous specimens of the latter from Illinois (typical of *P. asprigenis*) have been compared with the types of *E. iowæ*. *E. jessiae* is less elongate, with longer and higher fins, and we find but 47 to 50 scales in its lateral line. Otherwise, no difference of importance appears.

13. **Boleosoma olmstedi maculatum**, Agassiz.

Not uncommon.

C.—*Hundred and Two River.*

The two forks of the Hundred and Two River, near Bedford, Iowa, have the same character as the Chariton River, the bottom being still more muddy and the current equally sluggish. An abandoned stone quarry at Bedford has become filled with water from the river, and in this reservoir we obtained many specimens.

At Maryville, Missouri, the river is considerably larger than at Bedford, and has more current. The general character of the stream is, however, similar. Specimens were obtained at both these localities.

1. **Noturus flavus**, Rafinesque.

2. **Amiurus melas**, Rafinesque.

These specimens correspond exactly to the type of *Amiurus cragini*, Gilbert (Bull. Washburn Soc. Nat. Hist., 1883) and also to the type of

Amiurus obesus, Gill, also from Kansas. It differs from *A. nebulosus* in the much shorter pectoral spines, as well as in the shorter anal.

3. **Ictalurus punctatus**, Rafinesque.

4. **Ictiobus velifer**, Rafinesque.

5. **Catostomus teres**, Mitchill.

6. **Hybognathus nuchalis**, Agassiz.

A single dusky specimen, similar to that taken in the Des Moines.

7. **Pimephales promelas**, Rafinesque.

Many specimens taken in the quarry. They exhibit much variation in form and coloration, depending on age and sex. Some of them have the lateral line complete, thus corresponding to *Hyborhynchus nigellus*, Cope (♂), and *Hyborhynchus confertus*, Grd. (♀), while others have the tubes as little developed as usual in Eastern examples.

Most of the Kansas specimens of this species examined by us have the lateral line complete, or nearly so, while those from farther East have it always incomplete. The former possibly represent a tangible subspecies (*confertus*).

8. **Pimephales notatus**, Rafinesque.

9. **Notropis deliciosus**, Girard.

10. **Notropis topeka**, Gilbert.

(*Cliola topeka*, Gilbert, Bull. Washburn Soc. Nat. Hist., 1884.)

Our specimens are identical with Professor Gilbert's original types, with which they have been compared.

Males, in life, greenish, with bluish reflections and a bluish lateral stripe; a dark dorsal streak; scales above edged with darker. Snout, iris, cheeks, opercles, and sides flushed with red. Fins all bright crimson.

Female similar, the fins pale, a small blackish spot at base of caudal.

Teeth, 4–4; lat. l. 35; anal rays, 8; depth, 4 in length; eye, 3½ in head; 18 scales before dorsal.

Numerous specimens taken in the quarry.

11. **Notropis lutrensis**, Baird & Girard.

Abundant.

12. **Notropis umbratilis**, Girard.

Alburnus umbratilis, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 193. (♀).
Notropis nigripinnis, Gilbert, Bull. Washburn Soc. Nat. Hist., 1884.

Our specimens are identical with the original types of *N. umbratilis*, as we have ascertained by direct comparison.

The types of *N. nigripinnis* are larger in size than any of our specimens or any of Girard's. They are also deeper in body and with blacker fins.

As, however, we find the differences due to age and sex considerable in our specimens, we have no doubt of the identity of *nigripinnis* with

umbratilis. The species is a genuine *Lythrurus*, as stated by Gilbert, and is closely related to *N. ardens*, differing in coloration, in the more compressed form, and smaller eye.

Young male, in life steel-blue, smutty above with dark spots; a dark curved bar on scapular region. Top of head dusky, flushed with rosy. Caudal brick-red, with dark punctulations. Dorsal black, except at base mesially. No distinct black spot at its base in front. Pectorals, ventrals, and anal dusky, the anal tinged with rosy.

Females very pale, plain greenish, with dark punctulations above and at base of dorsal and anal. A dark dorsal streak; a black scapular bar, as in the male. Dorsal and anal pale, with dusky cross-shades; darker in larger specimens. Lat. l. 40 (44 in type of *umbratilis*).

Depth about $3\frac{3}{5}$ in length in females.

13. **Notropis megalops**, Rafinesque.

Common. The specimens taken here, as elsewhere in Iowa and Missouri, are very slender in form.

14. **Phenacobius mirabilis**, Girard.

15. **Hybopsis biguttatus**, Kirtland.

16. **Semotilus atromaculatus**, Mitchill.

17. **Lepomis humilis**, Girard.

Very abundant in the quarry.

In life, green above; belly more or less orange, its hue varying from golden to red. Opercular flap large, surrounded by a broad whitish margin. Posterior part of body and dorsal and caudal fins usually but not always with some dark-green spots. Some of these are always present on base of caudal. Some scattered spots of deep scarlet, about as large as pupil on sides of body; these usually very distinct. Opercle with larger (orange) spots. Three narrow orange stripes across cheeks. No blue on cheeks. Both dorsals broadly margined with orange. Caudal dusky, reddish on lower lobe only. Anal deep-orange or golden, darkest anteriorly. Ventrals a little paler; pectorals pale. One specimen had, in life, only deep olive-green spots, the belly and lower fins pale; no red or orange anywhere.

18. **Lepomis cyanellus**, Rafinesque.

19. **Boleosoma olmstedi maculatum**, Agassiz.

D. IX—13. Lat. l. 46.

D.—*Missouri River.*

The Missouri River at Saint Joseph, Missouri, is shallow, muddy, full of quicksands and snags, with a considerable current in places, the bottom in such cases being hard; in other places so charged with soft mud as to render it impossible to haul the seine. The seining done by us was on the Kansas shore, opposite the city. A few specimens were obtained from fishermen and a few others from a dirty slough.

1. **Lepidosteus osseus**, L.
2. **Leptops olivaris**, Rafinesque. Flat-head Cat.
3. **Amiurus melas**, Rafinesque.
4. **Amiurus natalis**, Rafinesque.
5. **Ictalurus punctatus**, Rafinesque.
6. **Ictalurus furcatus**, Rafinesque.
7. **Ictiobus cyprinella**, Cuv. & Val. Common Buffalo.
8. **Ictiobus urus**, Agassiz. Razor-back Buffalo.
9. **Ictiobus bubalus**, Rafinesque. Sucker-mouth Buffalo.

There appear to be three species represented among the Buffalo fishes taken at Saint Joseph, and these seem to correspond to the three species given in the Synopsis Fish. N. A. The whole group is much in need of thorough revision, but sufficient material does not yet exist in any collection. *I. bubalus* can generally be distinguished, but we cannot yet discriminate the young of *I. cyprinella* and *I. urus*, and more than three species may perhaps exist.

10. **Ictiobus carpio**, Rafinesque (35883).

A specimen 1 foot long is rather dusky in color. Head, $4\frac{3}{5}$ in length; depth, $3\frac{1}{10}$; the form, subfusiform; the back somewhat arched behind nape; anterior rays of dorsal about half length of the fin; eye about $4\frac{1}{2}$ in head; muzzle short, rather conic, somewhat projecting; D. 27; scales, 40–14; opercle, coarsely striate.

11. **Hybognathus nuchalis placita**, Girard.

We have compared our specimens with the original types of *Hybognathus placita* and can find no differences. The specimens look somewhat unlike the ordinary *nuchalis*, but no difference of importance seems to exist. The eye in *placita* is a little smaller than the average in *nuchalis*, the sides are more silvery, and the caudal peduncle possibly a little deeper.

12. **Notropis deliciosus**, Girard.

Described from Saint Joseph as *Hybopsis missuriensis*, Cope.

13. **Platygobio gracilis**, Richardson.

Abundant in the current of the river. *Platygobio pallidus*, Forbes, (Synopsis Fish. N. A., 220) is probably the young of this species.

14. **Hybopsis gelidus**, Girard.

Abundant in the river channel.

In life everywhere very pale, the sides silvery, without dark spots or punctulations, the lower lobe of the caudal blackish.

Head, 4 in length; depth, $5\frac{1}{2}$; Lat. l. 44; length, 2 inches.

Body slender, somewhat compressed. Head short, spongy in texture, its anterior profile bluntish, the thick snout overhanging the mouth. Mouth rather large, slightly oblique, the lower jaw included. Maxillary

not reaching front of eye, its length $2\frac{3}{5}$ in head. Barbel conspicuous, as long as eye. A raised rim above nostrils on each side, the space between them concave. Snout long, $2\frac{3}{5}$ in head. Eye very small, placed high, $4\frac{1}{2}$ in head. Interorbital space flattish, about as wide as eye.

Fins all very high, the pectorals somewhat filamentous, reaching past front of dorsal, a little longer than head. Dorsal elevated in front, its longest rays slightly longer than head, its insertion nearly over that of the long ventrals. Caudal long, very deeply forked, its lobes $3\frac{1}{4}$ in body.

This species is closely related to *H. hyostomus*, *H. æstivalis* (= *sterletus*), *H. montanus*, *H. labrosus*, and *H. zanemus*. These species form a group by themselves (perhaps worthy of generic distinction from *Hybopsis*), characterized by the great development of the maxillary barbel, and by their small size and feeble structure. All seem to abound chiefly in flowing water, especially in river channels.

15. **Dorosoma cepedianum**, Le Sueur.
16. **Hyodon alosoides**, Rafinesque.
17. **Micropterus salmoides**, Lacépède.
18. **Lepomis cyanellus**, Rafinesque.
19. **Lepomis pallidus**, Mitchill.
20. **Pomoxys annularis**, Rafinesque.
21. **Stizostedion canadense**, Smith.
22. **Aplodinotus grunniens**, Rafinesque.

E.—*Tabo Creek.*

Tabo Creek, about 6 miles east of Lexington, Missouri, is a small tributary of the Missouri River, rather swift and muddy. At the time of our visit its waters had risen on account of heavy rains, so that we got but few fishes. In the U. S. National Museum is a specimen (35758) of *Enneacanthus eriarchus* taken in this stream by Dr. P. R. Hoy.

1. **Amiurus melas**, Rafinesque.
2. **Ictalurus punctatus**, Rafinesque.
3. **Notropis deliciosus**, Girard.
4. **Notropis lutrensis**, Baird & Girard.
5. **Phenacobius mirabilis**, Girard.
6. **Semotilus atromaculatus**, Mitchill.
7. **Hyodon alosoides**, Rafinesque.
8. **Dorosoma cepedianum**, Le Sueur.
9. **Lepomis cyanellus**, Rafinesque.

F.—*La Mine River.*

Two tributaries of La Mine River were examined—Blackwater Creek at Brownsville, Saline County, Missouri, and Flat Creek, near Sedalia. The former is muddy and swift, and at the time was swollen by fresh-

ets. Flat Creek and its Spring Fork are clear and gravelly, being the only streams mentioned in this paper in which the bottom can be seen where the water is a foot in depth. Most of the specimens enumerated below are from Flat Creek:

1. **Noturus flavus**, Rafinesque.
2. **Amiurus melas**, Rafinesque.
3. **Ictiobus velifier**, Rafinesque. (*Carpiodes bison*, Agassiz).

Similar to specimens obtained later at Clinton. Scales, 48–14.

4. **Catostomus teres**, Mitchill.
5. **Moxostoma macrolepidotum duquesni**, Le Sueur.
6. **Campostoma anomalum**, Rafinesque.
7. **Pimephales notatus**, Rafinesque.
8. **Notropis lutrensis**, Baird & Girard.
9. **Notropis deliciosus**, Girard.
10. **Notropis umbratilis**, Girard.
11. **Notropis megalops**, Rafinesque. "Shiner."
12. **Notropis rubrifrons**, Cope.
13. **Notemigonus americanus chrysoleucus**, Mitchill.

Many specimens from a slough of Blackwater Creek. These are unusually slender in form, and in one of them the lateral line is developed only on the anterior half of the body. A. 12; Lat. l. 54.

Comparison of numerous specimens of *Notemigonus americanus* and *chrysoleucus* leads us to consider them as geographical varieties of one species, the northern form (*chrysoleucus*) having fewer anal rays and the scales more crowded and less regular. The following is the count of numerous examples:

Americanus.

	Anal.	Scales.
Virginia	15	46
Columbia, S. C.	15	46
Columbia, S. C.	15	50
Columbia, S. C.	15	46
Columbia, S. C.	17	46
Columbia, S. C.	17	43
Georgia	15	44
Florida	17	44

Chrysoleucus.

	Anal.	Scales.
Nova Scotia	13	51
Susquehanna River	12	47
Maryland	14	48
Michigan	12	48
Red River of the North	12	48
Illinois	13	51
Potomac River	14	48
Missouri	12	54
Missouri	13	49
Louisiana	13	46
Texas	13	49

14. **Phenacobius mirabilis**, Girard.
15. **Hybopsis biguttatus**, Kirtland. Blue Chub.
16. **Semotilus atromaculatus**, Rafinesque. Riffle Chub.
17. **Labidesthes sicculus**, Cope. Clear Tail.
18. **Micropterus salmoides**, Lac.
19. **Lepomis cyanellus**, Raf.
20. **Lepomis humilis**, Girard.
21. **Pomoxys annularis**, Raf.
22. **Boleosoma olmstedi maculatum**, Agassiz.
23. **Etheostoma variatum spectabile**, Agassiz.

This variety, abundant in the clear waters of Missouri, seems to differ from the typical *variatum* (= *cærulea*, Storer) only in the distinctness of the dark streaks which run along the series of scales along the sides of the back. No specimens having exactly this coloration have been observed east of Western Illinois, nor has the typical *variatum* been seen west of the Mississippi River.

24. **Aplodinotus grunniens**, Raf.

G.—*Osage River.*

Specimens were selected by us in Grand River, a large branch of the Osage River at Clinton, Missouri, a moderately clear stream, having some current, and at Tabo Creek at Calhoun, a similar stream, much smaller in size. In both the bottom is of clay, with some rock and gravel.

1. **Lepidosteus osseus**, L.
2. **Noturus flavus**, Rafinesque.
3. **Amiurus melas**, Rafinesque.
4. **Leptops olivaris**, Rafinesque.
5. **Ictalurus punctatus**, Rafinesque.
6. **Ictiobus velifer**, Rafinesque.

Specimens correspond apparently to the *Carpiodes bison* of Agassiz. Head, $4\frac{1}{5}$ in length; depth, $2\frac{1}{2}$. Longest dorsal rays not extending quite to the end of the fin. Eye large, 4 in head. Dorsal rays, 24. Scales, 36–12. Opercle coarsely striate.

7. **Catostomus teres**, Mitchill.
8. **Campostoma anomalum**, Rafinesque.
9. **Pimephales notatus**, Rafinesque.
10. **Cliola vigilax**, Baird & Girard.
11. **Notropis deliciosus**, Girard.
12. **Notropis gilberti**, Jordan & Meek.
13. **Notropis dilectus**, Girard.

(*Alburnus dilectus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 193.
Alburnus oligaspis, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 282.)

The specimens from Grand River agree with others from Poteau River, and with the original types of Girard, which came also from the neighhood of Fort Smith. *Alburnus oligaspis*, Cope, seems to be the young of the same species. Its anal rays are 11 instead of 14, as stated by Professor Cope.

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This species is related to *N. atherinoides* (= *rubellus*), but it appears to be distinct.

Color, pale greenish; sides, brightly silvery, a little rosy on the head and bases of the fins. Head shorter and less pointed than in *N. rubrifrons*, its length $4\frac{1}{3}$ in body. Eye large, longer than snout, 3 in head. Mouth oblique, smaller than in related species, the jaws subequal, the maxillary $3\frac{1}{3}$ in head, reaching front of eye.

14. **Notropis umbratilis**, Girard.
15. **Notropis megalops**, Rafinesque.
16. **Notropis lutrensis**, Baird & Girard.
17. **Phenacobius mirabilis** Girard.
18. **Hybopsis storerianus**, Kirtland.
19. **Semotilus atromaculatus**, Mitchill.
20. **Micropterus salmoides**, Lac.
21. **Dorosoma cepedianum**, Lac.
22. **Lepomis cyanellus**, Rafinesque.
23. **Lepomis humilis**, Girard.
24. **Hadropterus phoxocephalus**, Nelson.

Very abundant.

25. **Boleosoma olmstedi maculatum**, Agassiz.
26. **Etheostoma variatum spectabile**, Agassiz.

Abundant.

27. **Aplodinotus grunnieus**, Rafinesque.

INDIANA UNIVERSITY, *December* 19, 1884.

— ON ŒSTRELATA FISHERI AND Œ. DEFILIPPIANA.

By ROBERT RIDGWAY.

In the original description of *Œ. fisheri* (these "Proceedings," vol. 5, pp. 656–658), I tabulated for purpose of comparison what appeared to be the more striking differences between this species and *Œ. defilippiana*, Gigl. & Salvad., the diagnostic characters of the latter being derived from Mr. Salvin's description and colored plate in Rowley's "Ornithological Miscellany," part iv, p. 255, pl. xxxiii. The suggestion which I there made to the effect that "some of the differential characters adduced would (probably) not be found to hold good on actual examination of specimens" proves correct, as I am able to discover by having the opportunity of comparing specimens of the two species. The specimen of *Œ. defilippiana* now before me is a male, and is labeled in Jules Verreaux's handwriting. It belongs to the collection of the American Museum of Natural History in New York City, and agrees very closely with the description and plate cited above, except in some rather unimportant respects which will be alluded to further on. The locality

given on the label is "Ocean Pacifique," but some one has added in pencil "Coast of Peru."

Œ. fisheri and *Œ. defilippiana* are very distinct. The latter is decidedly less in general size, although the bill is absolutely larger than in *Œ. fisheri.* The lower parts are entirely white, except on the sides of the breast, where there is an encroachment of the pure ash-gray of the nape. The top of the head is quite uniform gray, except anteriorly, where the feathers are bordered with white, producing a distinct squamation. The wings are entirely concolor on their outer surface, and the inner web of the outer tail-feather is wholly pure white. The diagnostic characters of the two species should therefore be amended as follows:

Œ. fisheri.—Lower parts chiefly smoky plumbeous on the surface, this color nearly uniform on belly and flanks; greater wing-coverts, secondaries and tertials silvery plumbeous, broadly edged with pure white, the lesser coverts uniform dusky in strong contrast; rectrices (except middle pair) white, transversely vermiculated on both webs with ash-gray; top of head white, spotted with dusky; feet, including webs, dusky, except basal portion of inner web and toe. Wing 10.15, tail 4 (graduated for .90 of an inch), culmen 1, tarsus 1.25,* middle toe with claw, 1.70.

Œ. defilippiana.—Lower parts entirely pure white, except on sides of breast, which are ash-gray, like the nape. Outer surface of wings uniform dusky; rectrices uniform ash-gray, except two outer pairs, which have inner webs white (the second finely sprinkled with gray towards end), the outer webs finely mottled gray; feet, including webs, pale-colored (fleshy in life), except outer side of outer toe, which is dusky. Wing, 8.70–9.00; tail, 3.80–4.00 (graduated for 1.00 inch); culmen 1.04–1.05; tarsus 1.07–1.12; middle toe with claw, 1.40.

In pattern of coloration and in dimensions *Œ. defilippiana* resembles much more closely the *Œ. cooki;* but the latter has the pileum and nape very much darker (dark sooty slate, almost black in some lights), all the rectrices gray on both webs, and the feet dark colored except basally. *Œ. cooki* is also a little smaller than *Œ. defilippiana.*

SMITHSONIAN INSTITUTION, *January* 16, 1885.

ICTERUS CUCULLATUS, SWAINSON, AND ITS GEOGRAPHICAL VARIATIONS.

By ROBERT RIDGWAY.

The National Museum having recently acquired some very intensely colored examples of this species from Yucatan, which on first sight appeared conspicuously different from Arizona specimens of the same species, a careful examination was made of all the material accessible

*Not 1.35 as erroneously printed in original description.

to the writer, embracing altogether 45 adult males (6 from Yucatan, 9 from eastern and southern Mexico, and 30 from northwestern Mexico, including Arizona and Lower California). From this comparison of specimens the following facts become at once evident:

(1) That all specimens from Arizona, southern California (San Diego), Lower California, and western Mexico as far south as Mazatlan, are uniformly and decidedly paler in coloration than those from other portions of Mexico, the yellow never assuming an orange tint, but approaching quite closely to the tint known as Indian yellow, from which there is scarcely any variation in a series of 30 specimens. The difference is so great and so constant that the birds from the region in question should be separated as a well-marked geographical race.

(2) Specimens from Yucatan are, on the other hand, more intensely colored than those from southern and eastern Mexico, the orange color being both more intense and purer. It may be necessary to separate the Yucatan birds on this account, but having only six specimens, and these in somewhat worn plumage, I would not under the circumstances feel justified in making the separation. Should such a step be deemed desirable or necessary, however, I propose for the Yucatan bird the name *Icterus cucullatus igneus*.

The name *cucullatus* having been based by Swainson upon a specimen or specimens from Temiscaltepec, on the table land of southwestern Mexico, it follows that the form requiring a new name is that inhabiting the northwestern portions, or a definite region extending from Mazatlan to southern Arizona, thence west to San Diego, and again southward to Cape St. Lucas. This new form may be appropriately named *Icterus cucullatus nelsoni*, Arizona Hooded Oriole, Mr. E. W. Nelson having supplied the material upon which these observations are based.

Type, No. 98992, ♂ ad., Tucson, Arizona, April 26, 1884; E. W. Nelson.

PASSER SATURATUS, A NEW SPECIES OF TREE-SPARROW FROM THE LIU-KIU ISLANDS, JAPAN.

By LEONHARD STEJNEGER.

Passer saturatus, sp. n.

DIAGNOSIS.—Similar to *Passer montanus*, but washed all over with umber-brown, except on head, which is slightly tinged with ashy; the feathers on the breast are indistinctly edged with brown, the cross-bands on the wings are broad and strongly suffused with the brown color, and the whitish or grayish tips of the tertiaries have entirely disappeared, the whole border being brown; on back no trace of gray, and the black stripes small and few; all brown colors, except that of the head, deeper and richer.

DIMENSIONS.—Wing, 66^{mm}; tailf., 52^{mm}; expos. culmen, 10^{mm}; tarsus, 18^{mm}; middle toe with claw, 17.5^{mm}.

HABITAT.—Liu-Kiu Islands, Japan.

TYPE.—U. S. Nat. Mus., No. 21118.

COLLECTOR.—William Stimpson.

SYNONYM.—*Passer montanus* CASSIN, Pr. Philada. Acad. 1862, p. 314 (*nec* LINN.).

The type of this new species or form was collected by Dr. Stimpson, of the United States North Pacific Exploring Expedition, under Capt. John Rodgers, on the Liu-Kiu Islands, a group of islands situated to the south of Japan and politically belonging to that empire. The specimen was obtained in November, 1854.

I have before me for comparison a series of true *P. montanus* from Western Europe, Tenasserim, Canton, and Shanghai, China, and from the Northern and Middle Islands of Japan. These are practically identical, eastern and western specimens being absolutely indistinguishable both as to size and color, the only exception being the skin from Tenasserim, which has the back, particularly the rump, slightly more brownish than the others, the white parts, however, wing bands, tips of tertiaries, sides of head and neck, and under parts as pure as they. The average measurements of 8 males are: Wing, 69^{mm}; tailf., 52.5^{mm}; exposed culmen, 10.8^{mm}; tarsus, 17.6^{mm}; middle toe with claw, 18^{mm}.

There is, consequently, no appreciable difference in size, since the type specimen of *P. saturatus*, though somewhat smaller than the above averages, is equal to the smallest *P. montanus* of my series. The main distinction is the rich suffusion of the umber-brown color, which does away with all traces of gray and strongly stains the white markings.

Passer saturatus is evidently a local form of *P. montanus*, and probably an insular one, confined to the group from which the type was received. No intergradation between the two forms is known to occur, however, nor is it likely to be found, thus relieving us of the necessity of a trinominal, for the present at least.

The species here under consideration (*montanus* and *saturatus*) afford another example of a form, distributed over an immense area without showing any variation at all, which then on a restricted and isolated locality sets off a small branch showing distinctive features. In this respect *P. montanus* is analogous with *Asio accipitrinus* and *Lagopus lagopus* (cf. *A. portoricensis* et *galapagoensis*, and *L. lagopus alleni*).

UNITED STATES NATIONAL MUSEUM,

Washington, D. C., December 25, 1884.

DESCRIPTION OF A NEW SPECIES OF CONTOPUS FROM TROPICAL AMERICA.

By ROBERT RIDGWAY.

Contopus pileatus, sp. nov.

SP. CHAR.—Above uniform olive-gray or hair-brown, the feathers abruptly ash-gray beneath the surface. Entire pileum dull sooty brown, much darker than the back, and in marked though not abrupt contrast with the ash-gray of the postocular region and sides of occiput. Lores and suborbital region dusky, like pileum, but passing gradually into a lighter sooty grayish on the auriculars. Lower parts brownish gray, paler on the chin and upper part of the throat, the abdomen dull buffy whitish, the lower tail-coverts dull white with very pale brown central cuneate spots. Wing coverts with barely perceptible paler margins; secondaries more distinctly edged with pale grayish, or grayish white; primaries blackish brown or dusky, without perceptible lighter edges. Tail even, uniform hair-brown. Wing 3.00, 2d and 3d primaries longest, 4th next, the 2d shorter than the 5th; tail 2.80, culmen .55, width of bill at base .30, tarsus .60, middle toe .32.

Hab. ignot., but probably some portion of Tropical America.

Type in American Museum of Natural History, New York City.

The type specimen of this new species has been compared directly with examples of fifteen of the sixteen known species of the genus, but does not correspond at all with any of them. The only two which it in the least resembles are *C. ardesiacus* (Lafr.) and *C. richardsoni* (Aud.). The former, however, is very much larger and altogether darker in general coloration, while the latter is also decidedly larger, with emarginate tail, the colors much more olivaceous above and paler beneath. Apart from its peculiar proportions (being the smallest member of the genus), the new species is distinguished by its quite marked sooty gray cap, the absence of light edgings to the wing-coverts, and the very uniform light ash-gray color of the breast, jugulum, sides of head and neck, and sides.

Unfortunately nothing is known as to the locality or origin of the type specimen, the only example I have seen.

NOTE ON THE ANSER LEUCOPAREIUS OF BRANDT.

By ROBERT RIDGWAY.

Much confusion has hitherto existed regarding the white-cheeked geese of North America, among which there are variations of size probably unequaled in any other bird in the feral state. At least four very strongly characterized forms exist, which perhaps represent two distinct species, each with a larger and a smaller race. These forms have been

usually known by the names of *Bernicla* (or *Branta*) *canadensis*, *B. hutchinsi*, *B. leucopareia*, and *B. occidentalis*, and under these names, the last three of which, however, are united as trinomials to *canadensis*, they are treated in detail in the recently published Water Birds of North America, Vol. I, pp. 455–467. More recent investigations, however, made in conjunction with Dr. Stejneger, and with considerable additional material, have resulted in the discovery of certain facts which render some corrections necessary. These are the following:

(1) *Anser leucopareius* of Brandt is an exact synonym of *Anser hutchinsi*, Swains. & Rich.

(2) *Bernicla leucopareia* Baird (B. N. Am., 1858, pp. xlix, 765) is the same as that author's *B. occidentalis*, the latter name having been given in the text, under *B. leucopareia*, on p. 766, as a provisional name, on account of a suspicion that the bird might not be the *A. leucopareius* of Brandt.

From consideration of these facts it appears that the very small form breeding in western Alaska and migrating south to California in winter is not the *Anser leucopareius* of Brandt nor the *Bernicla leucopareia* of Baird, and that it requires a name. I accordingly propose for it the specific name *minima*, on account of its very small size, some specimens being less even than the brant, and the average size about the same as in that species. Its principal synonymy and characters are as follows:

Branta minima, sp. nov. Little Cackling Goose.

Bernicla leucopareia, CASS. Illustr. B. Cal. Tex., &c., 1853, 272, pl. 45, nec *Anser leucopareius*, BRANDT. (California.)

Branta canadensis, var. *leucopareia*, COUES, in Elliott's "Affairs in Alaska," 1875, 190; not of Key, 1872, p. 284, which = *B. occidentalis*, BAIRD. (Prybilov Islands.)

Bernicla canadensis leucoparia, RIDGW. Nom. N. Am. B., 1881, No. 594 b.—COUES, 2d Check List, 1882, No. 703; 2d Key, 1884, 689.

Bernicla canadensis, d. *leucopareia*, B. B. & R. Water B. N. Am., I. 1884, 456, 459.

SP. CHAR.—Similar to *B. occidentalis*, Baird, but very much smaller. Differing from *B. hutchinsi* in smaller size, especially the bill, and much darker coloration. White cheek-patches usually separated by a black stripe or spotting on the throat, and lower part of neck encircled by a more or less distinct white collar. Lower parts dark grayish brown, abruptly defined against the white of the anal region. Wing, 13.60–14.25; culmen, 0.95–1.12; depth of bill at base, .60–.70; width, .52–.55; tarsus, 2.40–2.60; middle toe, 1.90–1.95; rectrices, 16.

Habitat.—Pacific coast of North America, breeding abundantly about the Yukon delta and contiguous shores of Norton Sound, and migrating south in winter to California.

DESCRIPTION OF A NEW WARBLER FROM YUCATAN.

By ROBERT RIDGWAY.

Granatellus sallæi boucardi, subsp. nov.

Granatellus sallæi, SALV. & GODM., Biol. Centr.-Am. Aves, I., 1881, 161 (part; spec's ex Yucatan).—BOUCARD, P. Z. S., 1883, 441 (Yucatan).

SP. CHAR.—Similar to *G. sallæi*, SCL., but with chin and throat light plumbeous-gray instead of deep plumbeous, the upper parts decidedly paler plumbeous, the red of the breast paler, and the wing shorter.

Adult ♂ (type, No. 81760, U. S. Nat. Mus., Yucatan, 1879, A. Boucard): Above bluish plumbeous, the sides of the crown bordered by a broad but rather indistinct black line, beneath which, and extending from the upper posterior portion of the eye over the auriculars to the occiput, is a broad stripe of white; auriculars and cheeks lighter plumbeous than the upper parts, and the lores, malar region, chin, and throat still paler, or light ash-gray. Entire breast, middle of abdomen (longitudinally), anal region, and crissum fine pale rose-red; lining of wing, sides, and flanks, pure white. Tail black, the feathers edged, especially towards the base, with bluish plumbeous; tips of two outer rectrices narrowly white, and shaft of outer rectrix entirely white. Wing, 2.30; tail, 2.40; culmen, .55; depth of bill at base, .20; tarsus, .75; middle toe, .45.

An adult ♂ of *G. sallæi*, SCL., from Protrero, near Cordoba, Mexico (No. 41599, U. S. Nat. Mus.), measures as follows: Wing, 2.50; tail, 2.40; culmen, .55; depth of bill at base, .20; tarsus, .75; middle toe, .45. There is, therefore, no difference in dimensions except in the length of the wing, but the two forms may be easily distinguished by the marked difference in their coloration.

DESCRIPTION OF TWO NEW BIRDS FROM COSTA RICA.

By ROBERT RIDGWAY.

1. **Cyanocorax cucullatus,** sp. nov.

SP. CHAR.—Similar to *C. ornatus* (LESS.), but smaller (the wing about half an inch shorter), the blue hood without white border (except anteriorly), and the tibiæ blue instead of black.

Adult (type, No. 101845, U. S. Nat. Mus., Navarro, Costa Rica, October 30, 1882; Juan Cooper, collector; received from José C. Zeledon): Campanuliform patch covering upper part of nape, occiput, and hinder part of crown rich sky-blue, gradually passing anteriorly into silvery white; rest of head and neck, together with upper part of jugulum and back deep black, gradually changing, on breast, back, and scapulars to Berlin blue, this in turn changing, on remaining portions, above and below, to deep Paris blue, the tail with a greenish cast in certain lights.

Under surface of wings and tail uniform deep black. Bill and feet deep black. Wing, 5.00; tail, 5.80 (graduated for 1.50); culmen, 1.30; bill from nostril, .75; depth of bill, .42; tarsus, 1.40; middle toe, .85.

HABITAT.—Atlantic slope of Costa Rica (Rio Sucio, alt. 800 feet; Navarro, alt. 3,500 feet).

2. Vireolanius pulchellus verticalis, subsp. nov.

Vireolanius pulchellus, LAWR. Ann. Lyc. N. Y. VII, 1862 (Panama).—BAIRD, Review, 1866, 397 (part; spec's ex Costa Rica).—ZELEDON, Cat. Aves de Costa Rica, 1882, No. 99.

SUBSP. CHAR.—Similar to *V. pulchellus* (SCL. & SALV.), but with the whole crown bright green, like the back, the blue being confined to the forehead and nape, and the sides of the head decidedly paler green.

Adult ♂ (type, No. 34665, U. S. Nat. Mus., Angostura, Costa Rica, June 11, 1864; J. Carmiol): Entire upper parts, except forehead and nape, bright "parrot" green, the back slightly glossed with verdigris-green, and the outer webs of the primaries with a yellowish-green cast; forehead and nape light blue, the crown very slightly touched with the same; entire sides of head, including loral and malar regions, uniform emerald green; chin and throat pure gamboge-yellow, gradually changing to yellowish-green on jugulum, the whole lower parts being of this color, but more decidedly green laterally and more inclining to yellow on middle of abdomen, anal region, and crissum; lining of wing greenish gamboge yellow, and inner webs of remiges broadly edged with clear primrose-yellow. Maxilla blackish, with pale tomium; mandible pale (plumbeous in life?); legs and feet brownish (plumbeous in life?). Total length 6.25, extent 7.75 (Carmiol, MS.); wing, 3.00; tail, 2.10; culmen, .80; bill from nostril, .45; depth at base, .27; tarsus, .80; middle toe, .55.

HABITAT.—Costa Rica to Panama.

Examples of this species from Costa Rica and Veragua differ very decidedly from Mexican and Guatemalan specimens in the characters mentioned above. In the northern form, of which there are six examples before me, the entire pileum is blue, only the center of the crown being a little bit tinged with green; this central green spot, or, rather, indication of a spot, is present in all. In the true *V. pulchellus* the sides of the head are of a decidedly more intense green color, and there is usually (in five of the six specimens) a more or less distinct indication of a yellowish streak extending from the rictus to beneath the ears. Professor Baird has called attention to this character in his "Review of American Birds" (p. 398), and also to the variation in extent of the green on the crown, but, having only one specimen of the southern form for comparison, did not discover the geographical significance of the variations.

I have not seen Panama examples, but they are presumably similar to those from Veragua; or, perhaps, with still less blue, since an example from the latter country has no trace whatever of blue on the crown or occiput, while the blue of the forehead is more restricted than in specimens from Angostura, Costa Rica.

DESCRIPTION OF THREE SUPPOSED NEW HONEY CREEPERS FROM THE LESSER ANTILLES, WITH A SYNOPSIS OF THE SPECIES OF THE GENUS CERTHIOLA.

By ROBERT RIDGWAY.

Certhiola finschi, sp. nov.

SP. CHAR.—Similar to *C. martinicana*, Reich., but smaller, the superciliary stripe for the greater part bright yellow, and the upper parts (except head) decidedly paler.

Adult ♂ (type No. 90610, "Dominica"; C. J. Maynard & Co.): Pileum and entire side of head, including sides of throat, blackish slate, the pileum bordered on each side by a very sharply defined superciliary stripe, extending from the forehead to the end of the auriculars, of bright yellow, the anterior and posterior extremities, however, white; a small white spot on each side of the nape, about .10–.15 of an inch below the end of the superciliary stripe. Upper parts uniform dull slate-color, the lower part of the rump crossed by a narrow band of yellowish olive-green. Wing-coverts narrowly and indistinctly tipped with light grayish. A broad stripe on the middle of the throat, extending nearly to the angle of the chin, and about .40 of an inch wide posteriorly, grayish white. Lower parts olive-yellow, nearly pure yellow on the jugulum, paler and more grayish on the flanks; anal region and crissum dull white, the lower tail-coverts grayish basally. Inner web of lateral tail-feathers broadly tipped with white, the white extending about .30 of an inch from the tip; second feather with a smaller white terminal spot, and third feather with a narrow terminal margin of white. Wing, 2.30; tail, 1.65; culmen, .59; bill from nostril, .38; tarsus, .65; middle toe, .40.

Although the type specimen of this species is stated to have been obtained in Dominica, there is reason to doubt the correctness of this locality. Three other specimens bearing a similar label are identical with the Guadaloupe bird (*C. sundevalli*, nobis), and probably came from that island.

C. finschi is related to *C. martinicana*, Reich., but a typical example of the latter, from Martinique, differs in larger size, and in having the superciliary stripe entirely white; it also lacks the white spot on side of nape, and the pale tips to the wing-coverts, and has the upper parts black, like the head. It measures as follows: Wing, 2.50; tail, 1.80; culmen, .65; bill from nostril, .42; tarsus, .75; middle toe, .40.

An example of what is apparently *C. finschi* is mentioned by Dr. Finsch in his "Monographie der Gattung Certhiola," p. 789, as follows: "I am indebted to the curators of the imperial collection at Vienna

for a younger bird. This (received from Verreaux, in the year 1815, without a near statement of the locality) is quite like the old one described above, only that the mantle is somewhat duller, the superciliary stripe is not white, but yellow, the individual feathers bordering the white throat-stripe and the coverts of the secondaries, nearly all show a pale, buffy, whitish margin, which gives rise to a somewhat more distinct light cross-band on the wing; a second band, but by far less distinct, is indicated by the pale margins of the greater upper wing-coverts." (Translation.)

The measurements unfortunately are not given; but the plumage as described agrees very closely with that of the type of our *C. finschi.*

While it is possible that the yellow superciliary stripe and pale wing-covert tips indicate immaturity, the real young plumage, or first plumage, of the Certhiolæ is very different from that of the adult, the boldly-marked "pattern" of the latter being wholly wanting. At the same time, in the case of the type of *C. finschi* the very different proportions and dissimilar color of the back could hardly thus be accounted for.

In the collection of the United States National Museum are five certhiolæ, resembling *C. dominicana,* but differing in having the middle portion of the superciliary stripe yellow, and the upper parts more slaty. One of these is from Guadeloupe, and one from Dominica. The remaining three are stated on the label to have been obtained in Dominica, but the authority cannot, in this case at least, be depended on. These are certainly not *young* birds of *C. dominicana,* although they may represent some special phase of plumage in that species. For the present, however, I propose to consider them representing a distinct form, which it is proposed to name

Certhiola sundevalli, sp. nov. (?)

SP. CHAR.—Similar to *C. dominicana,* but superciliary stripe yellow for at least the anterior half, and the upper parts more slaty.

Adult (type No. 79953, U. S. Nat. Mus., Guadeloupe, W. I.; L. Guesde): Above blackish slate, darker on the head, the lower part of the rump crossed by a narrow band of yellowish olive-green. Forehead pale gray, darker anteriorly; a superciliary stripe confluent anteriorly with the gray of the forehead, extending back to the end of the auriculars, and yellow for the anterior two-thirds, the posterior extremity white; chin, throat, and cheeks, deep plumbeous; jugulum, breast, sides, and abdomen yellow, paler and more grayish on the flanks; anal region and crissum dull white, the longer feathers of the latter grayish basally. Lining of wing including axillars and inner margins of remiges pure white. Inner webs of rectrices tipped with grayish white, that on lateral feather extended nearly .40 of an inch from the tip. Wing, 2.40; tail, 1.65; culmen, .60, bill from nostril, .40; tarsus, .70; middle toe, .49.

Three specimens, stated on the labels to be from Dominica, but per-

haps not from that island, agree substantially with the type. Two of them, however, have much less gray on the forehead, and the yellow superciliary stripe commences immediately above the eye. Another, undoubtedly from Dominica, and without question an immature bird in transition plumage, has the forehead tinged with yellow.

Having had occasion, in connection with the determination of the above-described forms, and also with the comparison of a series of *C. caboti* from Cozumel, to carefully examine the entire collection of these birds in the Nationa Museum, the desirability of a new synoptical "key" to the species, became apparent. The subject was carefully and satisfactorily brought up to date in 1874 by Professor Baird (see *Hist. N. Am. B.*, I, pp. 426–428) but material for study, and consequently our knowledge of the subject, has been increased somewhat since the publication of Professor Baird's synopsis. The following key is based entirely on the National Museum collection, embracing some two hundred skins. It may be premised that division of the genus into groups or sections is somewhat difficult, from the fact that almost any character which may be selected to define these is more or less variable. Thus, in some forms it is difficult, if possible, to determine satisfactorily whether the head is concolor with the back or darker; while as to the wing-spot, one species of the group said to have none has occasionally a very obvious though small, "speculum"; while, on the other hand, a species of the other group has the speculum sometimes so reduced in size as to be practically obsolete.

KEY TO THE SPECIES OF THE GENUS CERTHIOLA.

A.—Plumage parti-colored (blackish, yellow, white, &c.).

a. A distinct white spot or "speculum" at base of primaries (rarely obsolete in *C. mexicana columbiana*).

§. Throat grayish white.

1. C. bahamensis. Yellow confined to breast; black loral streak very narrow; cheeks white almost to the eye; both webs of outer rectrices broadly tipped with white. *Hab.* Bahamas; coast of southern Florida.

2. C. caboti. Yellow extended over abdomen and flanks; black loral streak broader than the white above it, and continued broadly beneath the eye; white tip of outer tail-feather smaller, and mainly confined to inner web. Back darker. *Hab.* Cozumel I., Yucatan.

3. C. tricolor. Similar to *C. caboti* in extent of the yellow beneath, but agreeing with *C. bahamensis* in narrow loral and suborbital streak, broad white tips to both webs of outer rectrices, and larger wing spot; back darker even than in *C. caboti*. *Hab.* Island of Old Providence, Caribbean Sea.

§§. Throat light ash-gray.

4. C. mexicana. Back brownish slate; rump olive-green or olive-yellow; inner web of outer tail feathers with small terminal spot of white; wing-spot small, sometimes nearly obsolete; wing not more than 2.30 inches.

α. Mexicana. Rump olive-green. *Hab.* Mexico and Central America to Chiriqui.

β. Columbiana. Rump olive-yellow. *Hab.* Panama to Peru.

5. C. luteola. Back black; rump bright yellow; inner web of lateral tail feathers, with large terminal spot of white; wing-spot large; wing 2.30 or more. *Hab.* Northern South America (Tobago, Trinidad, Venezuela, coast of Colombia).

6. C. sancti-thomæ. Back slate-color; rump olive-yellow; throat light gray, as in *luteola*. *Hab.* St. Thomas and St. John's, W. I.

7. C. portoricensis. Back dark sooty slate, or blackish slate; rump olive-yellow; throat much darker gray than in *sancti-thomæ*. *Hab.* Porto Rico.

8. C. bananivora. Similar to *C. portoricensis*, but yellow of rump more restricted and lighter in tint; yellow of breast, lighter, and bill smaller. *Hab.* Haiti.

9. C. bartholemica. Forehead dull dark grayish, the superciliary stripe beginning immediately above the eye; wing-spots very small; lower part of rump olive-green. *Hab.* Island of St. Bartholomew, Lesser Antilles.

10. C. saccharina. Similar to *C. portoricensis*, but throat rather darker slate, breast, etc., clearer yellow, lower rump olive-green, and back more slaty. *Hab.* St. Vincent and Grenada.

11. C. flaveola. Similar to *C. portoricensis*, but throat much darker slate; breast darker or duller yellow; rump brighter yellow; wing-spot much more extended, and white spots on ends of outer rectrices, larger and involving both webs. *Hab.* Jamaica.

12. C. newtoni. Similar to *C. flaveola*, but wing-spot more truncate posteriorly, breast purer yellow, and rump olive-yellow. *Hab.* St. Croix, W. I.

b. No white spot or "speculum" at base of primaries.

§ Throat unicolored.

13. C. dominicana. Superciliary stripe indistinct anteriorly; the whole frontal region sometimes grayish, and the superciliary stripe sometimes (in younger birds?) partly yellow; throat dark slate; lower part of rump with an indistinct narrow band of olive-green. *Hab.* Islands of Dominica, Antigua, Barbuda, Nevis, St. Eustatius, Guadeloupe, and Saba, Lesser Antilles.

14. C. sundevalli. Similar to *C. dominicana*, but superciliary stripe with at least the anterior half yellow, and the back rather more slaty. *Hab.* Dominica and Guadeloupe. (May be a special phase of *C. dominicana*).

15. C. chloropyga. Throat ash-gray; back brownish slate; whole lower rump olive-yellow. *Hab.* Coast of Brazil, north to Guiana.

§§. Throat bicolored.

16. C. barbadensis. Upper part of throat slate-black, bordered laterally by a gray rictal patch, and below by a yellowish-white patch, separating the black from the yellow of the jugulum. Upper parts as in *C. dominicana*, but superciliary stripe broadest and most sharply defined anteriorly. *Hab.* Barbadoes, W. I.

17. C. martinicana. Throat grayish white medially, blackish laterally; back slate-black, superciliary stripe entirely white; no white spot on side of nape; wing 2.50, tail 1.85. *Hab.* Martinique.

18. C. finschi. Similar to *C. martinicana*, but back slate-color; superciliary stripe, mostly bright yellow; a small white spot on each side of nape. Wing 2.30, tail, 1.60. *Hab.* "Dominica." (???)

B.—Plumage unicolored (entirely black).

19. C. atrata. Deep black, but showing, distinctly an olive-green tinge on lower rump and on breast. *Hab.* St. Vincent and Grenada. (Perhaps a melanotic variety of *C. saccharina*).

The principal references and synonyms of the above-named forms are as follows:

+1. **Certhiola bahamensis**, Reichenbach.

Certhiola bahamensis, REICH., Handb. i, 1853, 253 (based on *Certhia bahamensis* CATESB. Car. tab. 59).—SUND. Öfv. of K. vetensk.-Akad. Stockh. 1869, 624.*—FINSCH, verh. k. k. zool.-bot. Gesell, Wien, 1871, 751, 752†.—BAIRD, Am. Nat. vii, 1873, 612‡; in Hist. N. Am. B., i., 1874, 428§, pl. xix, fig. 5.—RIDGW. Nom. N. Am. B. 1881, No. 159.

Certhiola flaveola, BAIRD, B. N. Am. 1858, 924; ed. 1860, pl. lxxxiii, fig. 3 (Indian Key, Fla.); Cat. N. Am B. 1859, No. 301.

Certhiola bairdii, CABAN. J. f. O. 1865, 412.—SUND., t. c., p. 621.

+2. **Certhiola caboti**, Baird.

Certhiola caboti, "BAIRD (MS.)" FINSCH, t. c., p. 790.—BAIRD, Am. Nat. vii, Oct. 1873, 612 (Cozumel I., Yucatan); in Hist. N. Am. B., i, p. 427.—SALV. Ibis, 1874, 327.—SALV. & GODM. Biol. Centr. Am. Aves, i, 1883, 251, pl. xv, fig. 4.

+3. **Certhiola tricolor**, Ridgway.

Certhiola tricolor, RIDGW., Pr. U. S. Nat. Mus. vii, July 29, 1884, 178 (island of Old Providence, Caribbean Sea).

—4. **Certhiola mexicana**, Sclater.

+(*α. Mexicana.*)

Certhiola mexicana, SCL., P. Z. S. 1856, 286 (South Mexico).—SUND., t. c., p. 623.—FINSCH, t. c., pp. 752, 772.—BAIRD, t. c., p. 612; in Hist. N. Am. B., i, p. 428.—SALV. & GODM. t. c., p. 250.

(*β. Columbiana.*)

? *Certhiola peruviana*, CAB., J. f. O. 1865, 413.—SUND., t. c., p. 623.

! *Certhiola peruviana*, BAIRD, tt. c.

Certhiola columbiana, CAB., t. c., p. 412 (Bogota).—SUND., t. c., p. 622.

+5. **Certhiola luteola**, Cabanis.

Certhiola luteola, CAB., Mus. Hein., i, 1851, 96.—SUND., t. c., p. 621.—FINSCH, t. c., pp. 751, 767.—BAIRD, t. c., p. 612; in Hist. N. Am. B., i, 427.

Certhiola major (part); CAB. t. c., p. 97 (Guiana).—SUND. t. c., p. 622.

? *Certhiola minor*, BONAP., Compt. Rend., 1854, 259.—SUND., t. c., p. 622.—FINSCH, t. c., p. 790.

+6. **Certhiola sancti-thomæ**, sp. nov.

Certhiola portoricensis (part), FINSCH, t. c., p. 760.—BAIRD, t. c., p. 611; in Hist. N. Am. B., i, p. 427 (part).

+7. **Certhiola portoricensis**, (Bryant) Sundevall.

Certhiola flaveola var. *portoricensis*, BRYANT, Pr. Boston Soc. N. H. Jan., 1866.

Certhiola portoricensis, SUND., t. c., p. 622.—FINSCH, t. c., pp. 751, 760.—BAIRD, t. c., p. 611; in Hist. N. Am. B., i, 427.

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* Ofversigt af slägtet Certhiola. Af Carl J. Sundevall. <Öfversigt af Kongl. Vetensk.-Akad. Förhand. [Stockholm] 1869, N:o 6, pp. 619—625.

† Monographie der Gattung Certhiola, von Dr. O. Finsch in Bremen. <Verh. der k. k. zool.-bot. Gesellsch. in Wien, 1871, pp. 739-790, Taf. iv. [A critical review or monograph of the species then known to the author, with a colored map illustrating their geographical distribution.]

‡ On some New Forms of American Birds, [including a] synopsis of the species of the Genus Certhiola, Sundevall. By Spencer F. Baird. < American Naturalist, vii, Oct. 1873, pp. 609-613.

§ The same synopsis, with some slight modifications, reprinted in "History of North American Birds," pp. 426-428, incl.

8. Certhiola bananivora, (Gmel.) Baird.

Motacilla bananivora, GMEL., S. N., I, ii, 1788, 951 (based on *Bananiste* of BUFFON and *Banana Warbler* of LATHAM; St. Domingo).

Certhiola bananivora, BAIRD, t. c., p. 612; in Hist. N. Am. B., i, 427.

Certhiola clusiæ, HERZ. *v.* WURT. Naumannia, ii, Heft. 3, 1852, 56 (no descr.).—FINSCH, t. c., pp. 751, 771.

9. Certhiola bartholemica, Sundevall.

Certhia bartholemica, SPARRM., Mus. Carls., fasc. iii, 1788, No. 57.—BECHST., Lath. Web. i, 1793, 611 (ex SPARRM.).

Certhiola bartholemica, SUND., t. c., p. 622.—FINSCH, t. c., pp. 751, 763.—BAIRD, t. c., p. 612; in Hist. N. Am. B., i, 428.

10. Certhiola saccharina, Lawrence.

Certhiola saccharina, LAWR., Ann. N. Y. Ac. Sci. i, June, 1878, 151 (St. Vincent); Pr. U. S. Nat. Mus., i, 1878, 190, 487.

11. Certhiola flaveola, (Linn.) Gray.

Certhia flaveola, LINN., S. N. ed. 10, 1758, 119 (based on SLOANE, Jam., 2, p. 307, t. 259; EDW. av. 122, t. 122).

Certhiola flaveola (part), GRAY, Gen. B., i, Jan., 1846, 102.—BP. Compt. Rend. 1854, 259.—SUND. t. c., p. 621.—FINSCH, t. c., pp. 751, 756.—BAIRD, t. c., p. 611; in Hist. N. Am. B., i, 427.

12. Certhiola newtoni, Baird.

Certhiola newtoni, BAIRD, Am. Nat., vii., Oct. 1873, 611; in Hist. N. Am. B., i, 427.

Certhiola flaveola, A. & E. NEWTON, Ibis, 1859, 67 (St. Croix).

13. Certhiola dominicana, Taylor.

Certhiola dominicana, TAYLOR, Ibis, 1864, 167.—SUND. t. c., p. 623.—FINSCH, t. c., pp. 752, 787.—BAIRD, t. c., p. 612; in Hist. N. Am. B., i, 428.

Certhiola frontalis, BAIRD, t. c., p. 612; in Hist. N. Am. B., i. 428 (Antigua).

14. Certhiola sundevalli, sp. nov.

15. Certhiola chlorophyga, Cabanis.

Certhiola chlorophyga, CAB., Mus. Hein. i, 1851, 97 (Bahia).—SUND., t. c., p, 624.—FINSCH, t. c., pp. 752, 779.—BAIRD, t. c., p. 613; in Hist. N. Am. B., i, 428.

Certhiola guianensis, CAB., l. c.—SUND. t. c., p. 624.

Certhiola majuscula, CAB., J. f. O. 1865, 413 (E. Peru). *Cf.* FINSCH, t. c., p. 778.

? *Certhiola minimi*, BP. Compt. Rend. 1854, 259.—SUND., t. c., p. 625.

16. Certhiola barbadensis, Baird.

Certhiola barbadensis, BAIRD, Am. Nat. vii, Oct. 1873, 612; in Hist. N. Am. B., i, 428.

17. Certhiola martinicana, Reichenbach.

Certhiola martinicana, REICH., Handb. Scans. 1853, 252, tab. DLXI., fig. 3824.—FINSCH, t. c., pp. 752, 788.—BAIRD, t. c., p. 612; in Hist. N. Am. B., i, 428.

Certhiola albigula, BP., Compt. Rend. 1854, 259.—SUND., t. c., p. 624.

18. Certhiola finschi, sp. nov.

19. Certhiola atrata, Lawrence.

? ? *Dicæum aterrimum*, LESS., Traité, 1831, 303 (hab. ignot.).—PUCH., Rev. Zool. 1846, 134 (St. Thomas).

Certhiola atrata, LAWR., Ann. N. Y. Ac. i, June, 1878, 150; Pr. U. S. Nat. Mus., i, 1878, 190 (St. Vincent), 269 (Granada).

The following is unknown to me:

Certhiola magnirostris, TACZANOWSKI, P. Z. S., 1880, 193 (Callacate, n. Peru, alt. 4,800–5,200 ft.).

ON HORNBLENDE ANDESITES FROM THE NEW VOLCANO ON BOGOSLOFF ISLAND IN BERING SEA.

By GEORGE P. MERRILL.

The rocks described below were received from Lieut. G. M. Stoney, by whom they were collected and donated to the National Museum. On account of the interest just now attached to the locality they seem worthy of a special description. It is well to remark in the beginning that none of the samples received show freshly fractured surfaces, but are in the form of irregular blocks with their corners broken and rounded. They were accompanied and covered with a fine sand and dust of the same mineral nature as the rocks themselves, but stained by sulphur and iron oxides. Even in the absence of definite information on the subject it seems safe to infer that they are simply ejected volcanic blocks, and not from recent lava flows, none of which have as yet been reported.

Two varieties of the rock were received, one consisting of a light-gray slightly purplish, fine grained and porous groundmass, in which small glassy feldspars and dark brown and green hornblende-like crystals are readily distinguishable by the naked eye. The texture is quite uniform, the brown hornblende being the more variable constituent, in one case a single crystal nearly half an inch in diameter being observed. The rock is rough to the touch and somewhat friable. Under the microscope it is found to consist of a light gray groundmass, in which are embedded deep reddish brown, strongly dichroic hornblendes, light green augites, and numerous crystals of a plagioclase feldspar, together with scattering grains of iron ore. The hornblendes are usually in irregular crystals, though an occasional quite perfect basal section was observed which showed a preponderance of the prismatic faces. The crystals are often elongated in the direction of their vertical axes, and a portion of them show the dark borders so commonly seen in the hornblende of andesites. The augite is light green in color and at first glance might readily be mistaken for a green variety of hornblende. Its cleavage and optical properties are, however, unmistakably those of augite.

In form the plagioclases are short and thick, showing but few twinning striations, sometimes none at all. A portion of them are clear and pellucid, while others are clouded through the presence of numerous cavities and impurities. In many cases the outer portion of a crystal is clear, while the interior is clouded, or again, both outer and interior portions may be clear while there exists an intermediate zone full of cavities. In addition to these the plagioclases contain numerous inclosures of a yellowish glass, which often bears a bubble, and hornblende and augite particles. A number of short and thick, clear, glassy feldspars are present, which show no sign of twinning, and which appear from their optical properties to be sanidin. Both sanidin (?) and plagioclase show at times a very evident zonary structure.

Apatite occurs but sparingly and in minute colorless crystals, showing but slight trace of the dusky interiors so often seen in the apatites of this class of rocks. The magnetite is, as a rule, in but poorly defined crystals.

The base proper of the rock consists of an aggregate of minute colorless microlites* and grains of opacite; there is also present a very weakly doubly refracting, colorless, interstitial substance, which, under a power of 300 diameters is seen to be composed of rounded and irregular imbricated scales like tridymite. So far as observed, however, none of these scales present a regular hexagonal outline, but resemble more closely those figured by Rosenbusch† than any I have seen figured elsewhere.

The dark variety of the rock is much more compact in texture, and bears a larger proportion of microscopic hornblende, which occurs in crystals of all sizes up to one-fourth of an inch in diameter. Under the microscope it is found to contain also a much greater proportion of minute feldspars scattered through the groundmass. As in the lighter variety, these are short and thick, being usually not more than twice as long as broad. The groundmass is much more dense, but under a high magnifying power is seen to consist mainly of the same colorless microlites and iron-ore. Little, if any, tridymite is present and no true glass was observed. In other respects the varieties seem nearly identical.

Samples of the rock submitted to Dr. T. M. Chatard, of the Geological Survey, for chemical analysis, yielded results given below:

[I is the light-colored tridymite-bearing variety; II, the dark variety.]

	I.	II.
Ignition	.99	.34
SiO_2	56.07	51.54
TiO_2	1.24	.32
Al_2O_3	19.06	20.31
Fe_2O_3	5.39	4.64
FeO	.92	3.56
MnO	.23	.32
CaO	7.70	9.55
MgO	2.12	3.16
P_2O_5	.16	.57
Na_2O	4.52	4.29
K_2O	1.24	2.47
	99.64	101.07

The low percentage of silica in the rocks is especially interesting, and would seem to point to the presence of very basic plagioclases. To satisfactorily determine this point an attempt was made to separate the feldspars from both rocks by means of the iodide of mercury and potassium solution. At a specific gravity of 2.7 a considerable quantity

* In a preliminary note on these rocks, published in Science of December 12, 1884, the base was stated by mistake to be *microfelsitic*. It should have read *microlitic*.

† Mikroscopische Physiographie der Mineralien, &c., p. 227.

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of the powder from the light variety came down, which, on examination with the microscope, proved to be nearly all feldspar, with small portions of the groundmass, and included iron-ores and hornblende particles. After standing over night a further precipitation was observed to have taken place, which, on examination, proved to be very pure feldspar. A sample of this last submitted to Professor Clarke for further examination yielded 55.29 per cent. of silica, which is about the right proportion for labradorite. Owing, however, to the somewhat crude method of separation, I do not feel at all certain that this is the only feldspar present, and it is very probable that with better facilities other results might be obtained. It is possible that the first portion to come down may have been anorthite, as suggested by Mr. Diller in Science of January 23, 1885.

With the dark variety of the rock no satisfactory results could be obtained, it being found impossible to separate the very impure feldspar from the groundmass with any facilities at my command.

Especial thanks are due Professor Clarke and Dr. Chatard for the excellent chemical work done by them in this connection.

NATIONAL MUSEUM, *February* 23, 1885.

NOTE.—In Science of May 30, 1884, Mr. J. S. Diller, of the U. S. Geological Survey, reports on a sample of volcanic sand that fell at Unalashka October 20, 1883, and which was regarded as doubtless a product of the same volcano as the andesite now under consideration. This sand gave on analysis 52.48 per cent. of silica, and, reasoning from the stand-point that in process of cooling the most basic minerals of a lava will be first to crystallize, and hence on being blown into fragments will give rise to a coarser powder than the more siliceous and still glassy portions, he suggests that in the case in hand the fine siliceous dust had been separated out by wind currents and carried to a greater distance before deposition. The sand remaining thus failed to give a correct showing regarding the acidity of the rock from which it was derived.

In Science of January 23, 1885, after learning the results of the silica determination in analysis II as given above, Mr. Diller expresses surprise at the seemingly anomalous case in which a lava is as a whole more basic than the sand derived therefrom. From an examination of the Unalashka sand, however, which Mr. Diller has kindly loaned me, I am convinced that it represents the finely divided state of the lighter-colored and more acidic lava, that given in analysis I, and bears no relation to the darker and more basic variety. Indeed, a comparison of the groundmass of the two rocks is in itself sufficient to show that the sand examined by him could only originate from the lighter-colored rock. Mr. Diller's first suggestion therefore still holds good.

ON CATHARTES BURROVIANUS, CASSIN, AND C. URUBITINGA, PELZELN.

By ROBERT RIDGWAY.

In the *Bulletin of the Nuttall Ornithological Club*, for April, 1880, in some "Notes on the American Vultures (Sarcorhamphidæ), with special reference to their generic nomenclature" (pp. 77–84, incl.), I made the following statement (p. 83) respecting the above-named species:—

"Recent authorities* having almost uniformly ignored the claims of this bird to specific rank, I have, in the absence of any opportunity to examine the type specimen in the Museum of the Philadelphia Academy, carefully read Mr. Cassin's original description in order to satisfy myself whether we are justified in the suspicion that Mr. Cassin's supposed species was based on a small specimen of *C. aura*. Upon reading Mr. Cassin's description I was suprised to find how well and unmistakably it applied to the bird usually called '*C. urubitinga*, Pelz.,' in every particular. In the description, as quoted below, I have italicized the phrases which are strictly and peculiarly diagnostic of *C.* '*urubitinga*,' in order to show at a glance how certain it is that Cassin's *C. burrovianus* is the same bird. The only question, it appears to me, can be as to the locality, which may be erroneous, since *C. urubitinga* is not known to occur anywhere out of Eastern South America, though the evidence to this effect, it should be remembered, is purely negative.

"The earliest notice of this species is that of Brisson (1760), the *Vultur brasiliensis* of this author being unquestionably the same species, as his full and very accurate description clearly shows. Therefore it is quite possible that some author may have applied the name *brasiliensis* to the species under consideration before Mr. Cassin's name *burrovianus* was bestowed upon it; in which event the proper specific term would be *brasiliensis*, and not *burrovianus*. I cannot find, however, that such use of Brisson's name has been made. It is altogether probable that *burrovianus* will stand.

"Mr. Cassin's description (Pr. Philad. Acad., March, 1845, p. 212) is as follows:

"'Head naked, smooth, with the nostrils large and oval; plumage of the body *entirely black*, with a greenish-blue gloss, paler beneath; *the feathers extend upwards on the back of the neck;* a small bare space on the breast. Wings long, the quills and tail-feathers black, with the shafts of the primaries white and conspicuous; third primary longest. The smallest American vulture known.

"'Total length (of skin) 22 inches, bill $2\frac{1}{2}$, wing 18, tail $8\frac{1}{2}$.

"'*Hab.*—Near Vera Cruz.

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* *Conf.* ELLIOT, Illustr. Am. B., ii, 1866; ALLEN, Bull. Mus. Comp. Zool., ii, 1871, p. 311; SHARPE, Cat. Acc. Brit. Mus., i, 1874, p. 28; GURNEY, The Ibis, 1875, p. 94.

"'This species resembles *C. aura*, Linn., in the shape of the bill and nostrils, and in having the tail rounded, but differs from it not only in size, but *the feathers extend upwards on the back of the neck and lie flat instead of forming a ruff;* the plumage of the specimen now described is black, *none of the feathers having pale margins*, as is commonly the case in specimens of *C. aura;* the shafts of the primaries are clear white, and the head is more entirely destitute of downy feathers. The tarsi are longer and more slender.

"'The head of *C. burrovianus* is quite smooth, in which, as in other respects, it is very different from *C. atratus*, Wilson.

"'This new species was obtained in the vicinity of Vera Cruz, by the late N. Burrough, M. D., in honor of whom I have named it, as a slight acknowledgment of his very valuable services to natural history and to this academy.'"

Having recently, through the courtesy of the officers of the Philadelphia Academy of Natural Sciences, been able to make an actual comparison between the type of *C. burrovianus* and one of the typical specimens of *C. urubitinga*, Pelz. (ex Natterer)—one of Natterer's specimens, in fact, obtained from the Vienna Museum—I am now able to speak with more confidence in the matter. It only needs to be said that the two specimens are as much alike as it is possible for two examples of the same species to be. They are identical in every character which distinguishes *C. urubitinga* from *C. aura*, and there cannot be the slightest question of their specific identity. *C. urubitinga*, Pelzeln, therefore becomes a synonym of *C. burrovianus*, Cassin,* the principal references being as follows:

Cathartes burrovianus, Cassin.

Cathartes burrovianus, CASS., Proc. Phil. Ac., ii, 1845, 212; Cat. Vult. Phil. Ac. Mus., 1849, 5; Illustr. B. Cal., Tex., &c., 1855, 59; U. S. Expl. Exp., 1858, 84; in Baird's B. N. Am., 1858, 6.—BAIRD, Cat. N. Am. B., 1859, No. 4.—SCL., P. Z. S., 1857, 3.—DRESSER, Ibis, 1865, 322 (near Brownsville, Texas).—ELLIOT, B. N. Am., ii, 1866, pl. xxvi.—COUES, Key, 1872, 222.

Catharista burroviana, GRAY, Hand-l. i, 1869, 3.—SHARPE, Ann. N. H., ser. 4, xi, 1873, 133.

Rhinogryphus burrovianus, RIDGW., in Hist. N. Am. B., iii, 1874, 344.—GURNEY, List Diurn. B. Prey, 1884, 4.

Œnops burroviana, SHARPE, Cat. B. Brit. Mus., i, 1874, 28, foot-note.

Cathartes urubitinga, PELZ., Sitz. Ak. Wien, xliv, 1861, 7 (ex NATT., MS.; Brazil); Verh. z.-b. Wien, 1862, 133; Orn. Bras. 1871, 1.—SCHLEG., Mus. P. B. Vult., 1862, 4.—SCL., P. Z. S., 1863, 224 (Surinam).—GURNEY, Cat. Rapt. B. Norw. Mus., 1864, 46.—SCL. & SALV., P. Z. S., 1867, 589 (Amazon); Nom. Neotr., 1873, 123.

Catharista urubitinga, GRAY, Hand-l. i, 1869, 3.

Œnops urubitinga, SHARPE, Cat. B. Brit. Mus. i., 1874, 28, pl. ii, fig. 2.

Cathartes aura, SCL. & SALV., P. Z. S., 1867, 753 (Chyavetas, E. Peru); 1873, 301 (do.).

* I had already made this disposition of it in *Hist. N. Am. B.*, vol. iii, p. 344.

Habitat.—Atlantic slope of tropical America, from Brazil to Vera Cruz, Mexico (perhaps to southern Texas); west through Amazon Valley to eastern Peru.

The type of *C. burrovianus* and the typical example of *C. urubitinga* compare in measurements as follows:

		Wing.	Tail.	Culmen.	Head.	Length of nostril.	Width of nostril.	Tarsus.	Mid. toe.
Type of *C. burrovianus.*	Vera Cruz, Mexico..	18.50	8.60	.80	3.20	.50	.30	2.40	2.20
Typical "*C. urubitinga.*"	Brazil (Natterer coll.)	18.50	8.50	.88	3.40	.52	.32	2.20	2.15

ON ONYCHOTES GRUBERI.

By ROBERT RIDGWAY.

With the single exception of *Buteo cooperi*, Cass., no alleged North American hawk has been so much a puzzle to ornithologists as the species described under the above name. The type specimen was received by the Smithsonian Institution in 1866 from F. Gruber, a San Francisco taxidermist, and was labeled "*Buteo fuliginosus*, California." This specimen was described as a new genus and species, in the "Proceedings" of the Philadelphia Academy of Sciences for December, 1870 (p. 149) and again in *History of North American Birds*, vol. iii, p. 254; in the latter case the description being accompanied by a full-length wood-cut. In November, 1872, there was removed from the Land office Department of the Patent Office building, in Washington, to the Smithsonian Institution, a collection of forty-five mounted birds, for the most part North American species, and, with one or two exceptions, unlabeled. There were altogether 38 species, of which 29 were common North American birds, 8 well-known tropical American species, and the remaining one a hawk, which was subsequently identified as *Onychotes gruberi* in the light phase of plumage. This specimen was described in *Rod and Gun* (newspaper, West Meriden, Conn.), vol. vi, No. 5, May 1, 1875, p. 65. In the "Bulletin" of the United States Geological and Geographical Survey of the Territories, vol. ii, No. 2, April 1, 1876, pp. 134, 135, both specimens were redescribed.

Having a suspicion that *Onychotes gruberi* might possibly be identifiable with some Old World species, the two specimens were, with the consent of the Director of the National Museum, sent to Mr. J. H. Gurney for examination, and while in his hands were inspected by other leading English ornithologists, none of whom could identify them with any other known species. Mr. Gurney published some observations on these specimens in the Ibis for July, 1881, pp. 396–398, illustrated by a colored plate (Pl. XII) showing both examples.

After having thus passed the test of examination by the best authorities, there seemed no further reason to doubt the validity of the species,

although the question of habitat was still involved in much uncertainty. The matter therefore remained quiescent until a colored plate of *Buteo solitarius*, Peale, a Sandwich Island species, published with the report on the birds of the Challenger Expedition (Zoology, vol. ii, Part VIII, Report on the Birds; 1881), struck me as bearing a very remarkable resemblance to the light-colored example of *Onychotes gruberi*. This renewed my suspicions, and led to the further investigations on which this paper is based. The type of *B. solitarius*, belonging to the Philadelphia Academy of Natural Sciences, was, through the courtesy of the officers of that institution, borrowed for comparison, and I am thereby enabled to offer the following remarks as throwing more light upon the subject.

I. The plate of *B. solitarius* in the report of the "Challenger" Expedition, the description there given of the same specimen, and that of another example forming part of the same collection given by Mr. Gurney on pp. 141, 142 of his "List of the Diurnal Birds of Prey" (1884), *agree far more closely with the light-colored example of "Onychotes gruberi"* than with the type of *B. solitarius*. In fact, the plate referred to is in some respects a better representation of the *Onychotes* than that of the latter given in the Ibis!

II. There being a very close correspondence in all essential characters between the two "Challenger" specimens of *B. solitarius* and the two examples of *O. gruberi*, scarcely any doubt can exist as to their specific identity, whatever may be their relationship to the true *B. solitarius*.

III. The type specimen of *B. solitarius*, while differing considerably in plumage and slightly in proportions from any of the four examples referred to above, is yet not sufficiently different to preclude the possibility of specific identity; while, on the other hand, the many points of similarity strongly suggest the probability of such relationship.*

Waiving the question of the localities where the examples of *Onychotes gruberi* were obtained, I think that the above evidence will justify the

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* The measurements of the five known species are as follows:

Species.	Wing.	Tail.	Culmen.	Bill along gape.	Tarsus.	Bare part of tarsus.	Middle toe.	Middle claw.	Inner claw.	Hind claw.
1. B. solitarius (type)	12.25	7.20	1.07	1.55	3.00	1.60	1.60	.87	1.05	1.10
2. B. solitarius (Challenger specimen)	12.00	7.20	1.10	1.50	2.80	......	1.70	.80	......	......
3. B. solitarius (Challenger specimen)	11.80	......	1.10	......	2.80	......	1.80	......	......	......
4. "O. gruberi" (type)	10.10	6.50	0.80	......	2.70	1.60	1.45	......	......	1.00
5. "O. gruberi" (light specimen)	11.50	7.30	......	......	2.80	1.80	1.60	......	1.00	(+1.00)

Measurements of No. 2 are from the "Challenger" report, cited above, and those of No. 3 from Mr. Gurney's "List of the Diurnal Birds of Prey."

The type of *O. gruberi* is probably a male, and is evidently a young bird. This specimen and the type of *B. solitarius* probably represent the dark and light extremes of plumage, respectively.

view that they are referable to the Sandwich Island species, according to which conclusion the synonymy of *Onychotes solitarius* stand as follows:

Onychotes solitarius (Peale) Ridgw.

Buteo solitarius, PEALE, Zool. U. S. Expl. Exp. Birds, 1st ed., 1848, 62 (Hawaii; type in Mus. Phil. Ac.).—SCL., P. Z. S., 1878, 348; Zool. "Challenger" Exp. Zool., ii, pt. viii, Birds, 1881, 96, pl. xxi.—GURNEY, List Diurn. B. Prey, 1884, 64, 141.

Pandion solitarius, CASS., Zool. U. S. Expl. Exp., Ornithology, 2d ed., 1858, 97, pl. iv.

Polioaëtus solitarius, SHARPE, Cat. B. Brit. Mus., i, 1874, 452.

Onychotes gruberi, RIDGW., Pr. Phil Ac., xxiii, Dec. 1870, 142, 149 ("California"); in Hist. N. Am. B., iii, 1874, 254 (figs.); Rod and Gun, vol. 6, No. 5, May 1, 1875, 65 ("California ?"); Bull. U. S. Geol. and Geog. Surv. Terr., ii, No 2, April 1, 1876, 134; Nom. N. Am. B., 1880, No. 446.—COUES, Am. Nat., v, 1871, 238; Key, 1872, 219, 2d ed., 1884, 553; Check List, 1873, No. 659; 2d ed., 1881, No. 529.—SHARPE, Cat. B. Brit. Mus., i, 1874, 158, foot-note ("*grueberi*").—GURNEY, Ibis, 1876, 476; ib. 1881, 396, pl. 12 ("*grueberi*"); List. Diurn. B. Prey, 1884, 71.

The genus or subgenus *Onychotes*, in its new signification, while closely related to *Buteo*, is tenable, with the following diagnosis:

GENERAL CHARACTERS.—Nostril nearly circular, or more properly semi-circular, its upper outline being less curved than the lower, more horizontal, its direction nearly parallel with the commissure of the bill; a cartilaginous tubercle is seen within the nostril in its upper portion. *Outstretched feet reaching to or beyond end of the tail;* tarsus long, nearly twice the length of the middle toe; outer toe decidedly longer than the inner, which reaches the second phalangeal articulation of the middle toe; hind toe shorter than the inner. Scutellation of the tarsi and toes as in the typical *Buteones*, there being a continuous single series of transverse plates on the posterior face of the former; those on the anterior face number 11–12. Claws proportionally large, those of the first and second toes considerably exceeding their digits in length; they are much graduated in size to the outer, which is only half the length of the posterior one; their shape is normally buteonine. A well-developed web between outer and middle toes. Wing short and much rounded, reaching to about the middle of the tail, which is slightly rounded, and more than half as long as the wing. Remiges, 24; rectrices, 12. Third, fourth, and fifth quills longest, and nearly equal; first shorter than eighth, sometimes shortest; second about equal to sixth, or a little longer; outer four with inner webs emarginated. Upper third of the tarsus densely feathered in front and on sides. Lores quite densely covered with strong black bristles, these extending forward so as to cover the entire cere beneath the nostrils. Superciliary shield bare and prominent.

The tarsi are proportionally longer than in *Buteo*, while the toes and claws are much longer, compared with the tarsus, than in the long-legged genera *Urubitinga*, *Leucopternis*, *Asturina*, and *Rupornis*.

NOTES AND DESCRIPTIONS TAKEN FROM SELACHIANS IN THE U. S. NATIONAL MUSEUM

By S. GARMAN.

Myliobatis Goodei, sp. n.

Disk about two-thirds as long as broad; lateral angles acute, bluntly rounded at the apices; posterior angles of pectorals nearly right. Snout very broad, short, with a slight prominence in front. The fin, or flange, beneath the eye at the side of the head is very wide, much wider than in either *M. freminvillei* or *M. californicus.* Eyes very small, without a prominence above in either male or female (immature specimens). Tail less than twice and more than one and two-thirds times the length of the disk. Dorsal fin smaller than that of *freminvillei.* Teeth in seven series, much shorter and narrower than those of *freminvillei*, third row about twice and middle row about four times as wide as long. Body smooth. Entire length 29, snout to end of ventrals 11.5, vent to end of tail 18.5, and width of disk 17.5 inches.

Olivaceous, darker on the center; white below. The Museum of Comparative Zoology has a large specimen which agrees well with this description.

Compared with *M. freminvillei*, this species has very small eyes; the pectoral below the orbit is wider than the eyeball, and the fin in front of the skull is but little wider than at its sides. In *freminvillei* the eyeball is twice as wide as the fin beneath it, and the fin in front of the skull is much wider than below the eye. Comparing specimens of about the same size, of both sexes, of *freminvillei*, *californicus*, and *goodei*, the latter is readily distinguished from the former two by the broad flange at the side of the head, the small eyes, the small teeth, and the broader lateral angles of the pectorals.

No. 9524 ♂, 9529 ♀. Central America.

Named for Professor G. Brown Goode.

Myliobatis freminvillei, Les.

Eyes about twice as large as those of *M. goodei* of the same size. The expansion of the pectoral below the eye is very narrow, a mere ridge, not half as wide as the same portion in Goode's ray. The pectoral near the acute outer angles is much narrower than in that species. The teeth are longer, and the median row is as wide as four of the next laterals. In *M. goodei* the teeth are much shorter and the median row is only about twice as wide as the next laterals, which in turn are about twice the width of the outer rows.

No. 14858, Noank, Conn. Total length 25.6, snout to ventrals 8.1, and width 14 inches.

No. 19482, east shore of Virginia. Entire length 25, snout to ventrals 8, and width 14.2 inches.

Dasybatus pastinaca, (Klein) Walbaum, 1793, Kleinii Ichthyol. Enod., p. 35.

Disk broad, four-fifths as long as wide; pectoral angles considerably in advance of the mid-length of disk; rostral angle very wide, tip of snout produced in a point beyond the balance of the margin. Center of body thick. Tail about one and a half times the length of the disk, with a narrow membrane or keel beneath. The body and tail are without asperities in this, a very young specimen. Mouth undulating, curved forward. Eyes rather small, smaller than the spiracle. Nostrils and nasal valves dark. Teeth small, blunt. Three elongate papillæ at the bottom of the mouth, close together. Color olivaceous brown, margins lighter, tail darker; light beneath.

Total length 17.5; tail 10; and width 9.5 inches.

Young male. No. 26507. No locality.

Dasybatus kuhlii, sp. M. & H.

Disk broadly rounded in front, snout not prominent—included in the broad curve of the anterior margin, lateral-posterior margin nearly straight. Margin of disk in front of head rather thick. Eyes prominent; orbit as large as the spiracle. Interspiracular distance equal distance of eye or mouth from tip of snout. Mouth small, curved; width equal more than half the distance from the end of the rostrum. Upper jaw forming an angle in front; symphysis turned downward; two papillæ on the floor of the mouth. Tail about one and a half times the length of the disk, with a short low cutaneous fold close behind the tip of the spine and a longer broader one below extending backward from near the spine's base; this fold grows narrower backward, but is continued nearly or quite to the extremity.

Olivaceous, uniform or with one or more rounded dark-edged small spots of light color over the posterior portions of the pectorals; white beneath. Tail darker behind the spine, with broad bands of white toward the end.

Total length 15.5; snout to end of pectorals 6.5; snout to end of ventrals 7.5; snout to mouth 1.1; and width 8 inches.

No. 26519. No locality.

Dasybatus, sp.

Fœtus 7 inches in length, of which 5 is tail. Snout and pectorals rounded, former not prominent. Tail with a membranous expansion above and another below, the latter wider and longer.

No. 26544. Japan.

Dasybatus varidens, sp. n.

Disk broad, four-fifths as long as broad, angles bluntly rounded. Snout blunt, without a prominence. Eyes rather large, larger than the spiracles. Mouth medium; its outline appearing as if the middle third of its length had been set forward a short distance ahead of the other two-thirds. On the upper (anterior) jaws the teeth at each end of this middle third, in the angles, are larger, triangular and pointed. Two

papillæ on the floor of the mouth. Tail one and a third times the length of the disk—from snout to end of ventrals, with a long narrow fold on the lower side—under and behind the spine, and a short but prominent one on the top, just behind the tip of the spine. The pectoral angles are nearly opposite the middle of the length of the disk. In this specimen, a young male, the disk is without asperities.

Entire length fourteen inches; disk about six; width seven and a half.

Color, rather light reddish brown or olivaceous; tail encircled by white rings, the broadest near the end. The species resembles *D. kuhlii*, but has a broader disk and no spots.

No. 6529. Hong-Kong, China.

This ray would be placed in the section *Hypolophus* with *D. sephen*. Excepting the angular outline of the mouth and the larger teeth in the angles of this outline in the upper jaw, there is little to separate this from other *Dasybati*.

Urolophus nebulosus, sp. n.

Disk subround, resembling that of *U. halleri*, with asperities about the middle over the posterior portion of the abdominal cavity. Without a median series of tubercles on back or tail. Three small papillæ at the bottom of the mouth. In shapes of body and caudal closely allied to *U. halleri*.

Entire length 12, snout to ends of ventrals 7.5, to ends of pectorals 7, and width 7 inches.

Clouded olivaceous above; whitish below.

No. 7356; Colima, Mexico.

A specimen of *U. halleri* measures in entire length 13, snout to ends of ventrals 8.4, to ends of pectorals 7.4, and width 7.4 inches.

Urolophus torpedinus, Desm.; M. & H.

Fœtus, length 5 inches. The membranous flap from above the upper posterior portion of the orbit forms a broad cover for the spiracle. It is quite as large as the spiracle, rounded above and produced in an acute angle extending behind the opening. The spiracular opening is an elongate slot and the valve is well developed.

Very light olivaceous freckled with brown. Posterior half of tail obscurely ringed with brown and lighter color.

Specimen 8184. New Jersey.

Urolophus fuscus, sp. n.

Disk smooth, subquadrangular, hardly as broad as long, forming a blunt angle in front, tip of snout prominent. The tail from the vent equals the distance from the same point to the anterior edge of the nostril, expansions of fin medium, tip blunt, insertion of spine a little anterior to the middle of the length from the vent. Ventrals medium. Claspers short, stout. Eye small, orbit as long as spiracle, interorbital space as wide as mouth, which is less than half the distance of the latter

from the tip of the snout. Mouth medium, curved forwards, with three papillæ on its floor—middle one bifurcate at its tip.

Entire length, $12\frac{1}{2}$ inches; snout to hinder edge of vent, 7; snout to mouth, $1\frac{8}{10}$; snout to end of ventrals, 8; width, $7\frac{6}{10}$.

Color, apparently uniform light reddish brown or olive. The shape of this specimen resembles that of *Dasybatus pastinaca*. The species is near *U. cruciatus*, which is broader than long, and of which the snout does not project.

No. 7058. Off east coast Niphon.

Another specimen, 26543, also from Japan, has a total length of $5\frac{5}{8}$ inches, snout to vent $2\frac{3}{4}$ and to end of ventrals $3\frac{1}{4}$, and a width of disk of $3\frac{5}{8}$.

This appears to be the young of 7058. There are differences: the snout is not prominent; the disk is wider in proportion to its length, more broadly rounded, and retains its greater width posteriorly; and the color is darker. The larger specimen, however, is faded, and the other differences are such as age renders less patent.

Narcine timlei, Bl. Schn.; Henle.

Very young specimen. Vent in the middle of the total length. Insertion of dorsal slightly behind the bases of the ventrals. Caudal with a blunt angle opposite the end of the vertebral column.

Light brown, thickly freckled with darker. Large blotches of darker between eye and lateral margin, between shoulder and lateral margin, and between the spiracles; there is one near the pelvis on each side of the dorsal median line, and one between each of these and the lateral margin. There is also a spot on each side of the base of each of the dorsals and one on the base of the tail. The upper portions of the fins are darker.

No. 26545. Hong-Kong, China.

Raja fusca, sp. n.

Specimens taken from the egg-case. Disk three-fourths as long as wide. Snout moderately prominent. General outline similar to that of *R. ocellata*. Tail from vent equals the length of the disk including the ventrals, depressed, rather broad at the dorsals, behind which it extends in a long point that probably is much reduced in comparative length in the adult. Teeth in thirty series. Eyes moderate, interorbital space nearly half their distance from the end of the snout. Mouth broad, with a slight forward curve. A pair of large spines in front of each eye; a single spine above each spiracle; one behind the head on the anterior end of the vertebral column, sometimes a second behind this on the shoulder girdle, and a median row on the tail beginning behind the vent, and reaching the second dorsal. Dorsals separated by two spines. Excepting these spines, the back is smooth.

Light reddish brown. A black ring about half as wide as the mouth incloses a lighter colored space near the shoulder girdle on each pectoral.

Length $4\frac{3}{8}$, width 2, and length of pectorals $1\frac{1}{2}$ inches.

No. 26542. Japan.

Raja senta, sp. n.

Shape of disk resembling that of *R. eglanteria*. Snout extending beyond the angle formed by the anterior margins of the pectorals, acute and flexible at the tip. Interorbital space concave, narrow, three and two-thirds times in the distance from the eye to the end of the snout. Mouth moderately wide, nearly twice in the pre-oral length, very little curved forward. Eyes and spiracles small. Teeth in thirty-six to forty series. Tail slender, tapering gradually, as in *R. granulata*, but a little more depressed than in that species; it does not extend behind the tip of the dorsal. Entire upper surface covered with very small, closely set, sharp spines. Each spine is slender, acute, and strongly hooked backward over a broad stellate base. A series of large spines on the vertebral line, interspersed with smaller ones, becoming very small on the posterior half of the tail. A group of two or three large hooked spines in front of each eye, a similar group above each spiracle, and another on each shoulder. Tail covered with the fine scales above, below, and on the sides. A few spines of small or moderate size on the anterior portion of the rostral cartilage and across the back of the head. The long, narrow dorsals are not separated by spines.

Olivaceous, clouded with darker. A white spot on the middle of the back, behind the shoulder girdle. A white band across the tail, at the ends of the ventrals.

No. 24309. Provincetown, Mass. Entire length 11.5, snout to ends of pectorals 7, and tail from vent 6 inches.

No. 21004. Le Have Bank. A deep-water species. The color of the larger specimen is a rather light reddish brown, apparently uniform.

Raja Jordani, sp. n.

Disk broader than long; little sharper than a right angle in front. Snout pointed, rather sharp and narrow at the end. The width of the disk is about one and a half times the length of the tail from the ventrals. Anterior margin of pectoral undulated, little concave. Width of posterior lateral portion of pectoral—parallel with the margin—about equal to distance from snout to shoulder girdle. Outer angle of pectoral behind the mid-length of the disk; posterior angle rounded. Tail moderately slender, tapering regularly to a point, depressed. Dorsals separated by a large spine; posterior supplemented by a membraneous expansion on the top of the extremity of the tail. Interocular space broad, deeply concave, three times in the distance from the eye to the end of the snout. Eye moderate, as large as the spiracle. Mouth wide, curved forward, one and two-thirds times in its distance from the end of the snout. Teeth sharp-pointed, in thirty-eight rows. On the rostral cartilage, the skull, the translucent rostral spaces, and along the anterior margins of the pectorals the skin is rough with small spines. A row of larger spines along the orbital ridges and the median line of back

and tail. No lateral series of large spines on the tail on this specimen, a male. A couple of large spines side by side in front of and near the dorsals, somewhat as in *R. clavata*. A group of large spines on the anterior extremity of each pectoral and a single row of retractile hooks on each near the outer angle. The greater portion of the disk is smooth. The claspers are long, slender, tapering, acutely pointed. Instead of bearing a sickle-shaped hook on its extremity, as in *R. erinacea*, the stylus of the clasper is forked and one of the slender branches becomes pointed and flexible and the other curved, expanded at the end, and sharp edged.

Total length 23; snout to vent, 11.5; snout to shoulder girdle, 6.75; snout to mouth 3, and greatest width 15.5 inches.

Color dark olivaceous, lighter toward margins, with white or translucent spaces at each side of the rostrum. Mottled and spotted with dark beneath the thoracic region. A rounded spot of light color around a dark center on each pectoral near the shoulder.

No. 16704. San Francisco, Cal.

Named for Prof. D. S. Jordan.

A REVIEW OF THE AMERICAN SPECIES OF FLYING FISHES (EXOCŒTUS).

By DAVID S. JORDAN and SETH E. MEEK.

In the present paper we have attempted to give the synonymy of the American species of *Exocœtus*, with an analytical key by which those known to us may be distinguished. Some of the less-known forms we have described in detail.

There are few groups of fishes in which our knowledge is in a more confused state than in this. It is our hope that the present paper will, at least, not make matters worse. This paper is in some regards supplementary to that of Dr. Lütken (Vidensk. Meddel. Naturh. Foren. 1876), which is the only critical review of the species of this group thus far published.

It is evident that few, if any, of the flying-fishes are local in their distribution; many of them are certainly found in all warm seas. Several of the supposed East Indian forms will doubtless prove, on further comparison, to be identical with Atlantic species.

The multiplication of nominal species on characters peculiar to immature individuals has been carried to an unfortunate extreme. It is to be earnestly hoped that future writers who may possess specimens of bearded *Exocœti*, or of other young flying fishes of less than 5 or 6 inches in length, will content themselves with describing such specimens without imposing on them any new specific names. The changes due to increased age are often remarkable, and, in most cases, the supposed characters of species based on young specimens are characters of immaturity, common to the young of many flying fishes.

The material examined by us consists of the specimens in the collection of the museum of the Academy of Natural Sciences at Philadelphia, which have been very carefully studied by Mr. Meek; of the collections of the Indiana University, and of part of the *Exocœti* in the U. S. National Museum. Fifteen of the species here admitted have been studied by us, two others (*E. bahiensis*, *E. cyanopterus*) being known to us only from descriptions.

The species here noticed fall naturally into four subgenera or genera, for which we adopt the names *Fodiator*, *Parexocœtus*, *Halocypselus*, and *Exocœtus*. On the whole, it seems more convenient to treat these groups as genera, but whether genera or subgenera is not a matter of much importance.

Most of the species belong to the typical and most highly specialized genus, *Exocœtus*. The other genera mark transitions in the direction of *Hemirhamphus*.

The name *Cypselurus*, has been used by Swainson, Weinland, and others for those species which are provided with one or two fleshy barbels or ribbons at the chin. These, we are fully convinced, are the young of other nominal species, which are destitute of barbels. It is probable that these appendages disappear at different ages in different individuals. In two species, *mesogaster*, usually described as destitute of barbels and *furcatus* described as with barbels, we have examined specimens both with and without these appendages.

ANALYSIS OF GENERA OF FLYING-FISHES.

a. Roof of mouth (vomer, palatines, pterygoids) and tongue provided with teeth; body not angular in outline (elliptical in cross-section); pectoral fins moderate, not reaching beyond middle of dorsal fin; ventrals rather long, inserted behind middle of body; dorsal fin elevated; anal long, its base scarcely shorter than that of dorsal.

b. Snout long, slender, and pointed, much longer than eye; lower jaw acute, the tip much projecting (approaching *Hemirhamphus*) .... FODIATOR, 1.

bb. Snout short, much shorter than eye; lower jaw scarcely produced at tip. PAREXOCŒTUS, 2.

aa. Roof of mouth and tongue, with few teeth or none; body angular in outline (a cross-section subquadrate); pectoral fins very long, their tips usually reaching nearly to base of caudal; lower jaw little prominent; snout short.

c. Ventral fins inserted anteriorly, much nearer tip of snout than base of caudal, not used as organs of flight, their tips not reaching nearly to front of dorsal; anal fin long, its base nearly equal to that of dorsal. HALOCYPSELUS, 3.

cc. Ventral fins inserted posteriorly, more or less nearer base of caudal than tip of snout, used as organs of flight, their tips reaching past middle of base of anal .... EXOCŒTUS, 4.

GENUS I.—FODIATOR.

FODIATOR, genus nova (*acutus*).

This group, which seems to us of generic value, agrees with *Parexocœtus* in dentition and in general characters, differing in the form of its jaws, which indicate a transition toward the genus *Hemirhamphus*. Per-

haps it should be considered as a subgenus under *Parexocœtus*, but in any regard it seems desirable to allow it a distinct name.

But one species is known.

ANALYSIS OF SPECIES OF FODIATOR.

a. Snout long, about half longer than eye, 2½ in head; lower jaw much projecting, the half-beak at its symphysis about one-third the length of the snout. Origin of ventral fin midway between posterior margin of preopercle and last caudal vertebra. Pectoral fins half length of body, their tips reaching a little past front of dorsal; the first ray simple, about ⅘ length of the fin, the second ray divided. Ventrals 1½ in length of head, their tips scarcely reaching front of anal. Dorsal and anal fins inserted opposite each other, the base of the anal slightly shorter than that of dorsal. Dorsal fin high, its longest ray 1⅓ in head. Head 3½ in body; depth 5; eye 3¾ in head. Color blue above, silvery below. Pectoral fins black on their posterior half, shading into lighter posteriorly; a large black blotch on the upper ⅗ of anterior rays of dorsal; ventrals and anal white; caudal dusky .... ACUTUS, 1.

1. Fodiator acutus.

Exocœtus acutus, Cuvier & Valenciennes, Hist. Nat. Poiss., 1849, 125 (Surinam; Nice); Günther, Cat. Fish. Brit. Mus. 1866, 281 (about 100 miles off Fernando Po).

Habitat.—Tropical America; ? Mediterranean.

This interesting species is known to us from a single specimen in the museum of the Academy. It is 6¼ inches in length, and was brought by Dr. Ruschenberger from Panama.

GENUS II.—PAREXOCŒTUS.

PAREXOCŒTUS, Bleeker, Nederl. Tydschr. Dierk. iii, 1865, 105 (*mento*).

This genus appears to be sufficiently distinct from *Exocœtus*, differing in the form of the body as well as in the dentition. The species are small in size and apparently few in number.

ANALYSIS OF SPECIES OF PAREXOCŒTUS.*

a. Pectoral fins of moderate length, their tips not reaching past middle of dorsal fin; origin of ventrals behind middle of body, their tips about reaching first ray of anal; body not angulated, elliptical in section; roof of mouth with teeth; snout short, shorter than eye, not pointed; lower jaw not produced.

b. Ventrals inserted at a point midway between pupil and last caudal vertebra, their tips reaching slightly past front of anal. D. 12; A. 13. First ray of pectoral about ⅘ length of second, which is divided; dorsal fin very high; its anterior rays reaching base of caudal; caudal short; lower jaw little obtuse, with a very slight symphyseal knob. Body deep blue above; fins all pale, except the dorsal, which has a large black blotch on its anterior rays ...... MESOGASTER, 2.

bb. (Ventrals inserted at a point midway between tip of snout and base of caudal, their tips reaching first ray of anal. D. 11, A. 13. Snout very short; lower jaw with a very small pointed tubercle at the chin; pectoral fins half length of body; dorsal high and pointed .... MENTO.)

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* For purposes of comparison, we add here the characters of the type of the genus, *Parexocœtus mento*, from the Pacific. The latter species may perhaps not be distinct from *E. mesogaster*. *E. brachypterus*, Solander, a species provided with two short barbels at the chin, is doubtless identical with *E. mento*, as already suggested by Dr. Günther. As Valenciennes states that the little tubercle at the chin in *E. mento* "forms a vestige of half-beak before the mouth," we do not venture to place it in the synonymy of *E. mesogaster*.

2. **Parexocœtus mesogaster.**

Exocœtus mesogaster, Bloch, Ichthyologia, pl. 399 (on a drawing by Plumier); Bloch & Schneider, Syst. Ichth., 1801, 430 (copied); Mitchill, Trans. Lit. and Phil. Soc. 1815, 443 (Southern coast); Cuv. & Val., xix, 1846, 87 (Cuba); Poey, Syn. Pisc. Cubens., 1868, 385 (copied); Poey, Enumeratio Pisc. Cub. 1875, 122 (copied); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 588 (Charleston); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 143 (Pensacola; no descr.).

Parexocœtus mesogaster, Jordan, Proc. U. S. Nat. Mus., 1884, 34 (Pensacola; no descr.).

? *Exocœtus orbignianus*, Cuv. & Val., xix, 131, 1846 (Montevideo; based on a drawing); Günther, vi, 285 (copied).

Exocœtus hillianus, Gosse, Nat. Sojourn Jamaica, 1851, ii, tab. 1, f. 1 (Jamaica); Poey, Memorias, ii, 1861, 301 (Cuba); Poey, Syn. Pisc. Cub., 1868, 384 (Cuba); Poey, Enumeratio Pisc. Cub., 1875, 122; Lütken, Vid. Medd. Naturh. Foren., 1876, 397 (Atlantic; Antilles; Honolulu); Cope, Trans. Am. Phil. Soc., 1871, 461 (St. Martin's); Jordan & Gilbert, Syn. Fish. N. A., 1883, 903; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 262 (Pensacola).

Exocœtus gryllus, Klunzinger, Fische des Rothen Meeres, 1870, 586 (Red Sea; fide Lütken).

Habitat.—East Indies; West Indies, north to Newport.

This little flying-fish is the most abundant species along our South Atlantic coast. We have adopted for it the name *mesogaster*, believing it to be the original *mesogaster* of Bloch, as well as the *mesogaster* of Mitchill and of Valenciennes, although none of these writers have given descriptions of any value.

The *hillianus* of Gosse is of course the present species. Lütken states that the *gryllus* of Klunzinger is also the same, the alleged distinctive character of the latter not really existing.

The *orbignianus* of Cuv. & Val. seems to have been based on a poor drawing of the present species.

Three specimens of this species are in the museum of the Academy—one 7 inches long from the Sandwich Islands, one $5\frac{1}{2}$ inches long from Newport, R. I., and one $4\frac{1}{4}$ inches long from St. Martin's. The one last mentioned has two short barbels on tip of lower jaw. These barbels are ribbon-shaped, black, and about three-fifths diameter of the eye. In the specimen from Newport there are also barbels, but much less developed than in the former specimen. In the Sandwich Island specimen no barbels exist. Otherwise the three agree closely, and evidently all belong to the same species. Specimens from Florida in the United States National Museum and in the museum of the Indiana University have no barbels, but otherwise agree with the others.

It is evident that the barbels constitute a character of youth, in this species at least.

The following description is taken from the specimen above noted, from the Sandwich Islands:

Head $4\frac{2}{5}$ in length of body; depth, 5; D, 12; A, 13; about thirty-eight scales in the lateral line, five rows of scales between lateral line and dorsal fin.

Body elongate, compressed (not angulated), rather deep; width of body at base of pectorals, 2 in head; head narrow, compressed, almost trenchant below; inteorbital area flattish, about as wide as eye, 3 in head.

Snout short, rather pointed; its length $4\frac{1}{4}$ in head; teeth on tongue and palatines; gill rakers numerous, long and slender; pectoral fins of moderate length; their length $1\frac{2}{3}$ to 2 in length of body; their tips reaching middle of base of dorsal fin; second ray of pectorals divided; dorsal fin very high, its longest rays about $\frac{1}{6}$ longer than head; base of dorsal about $1\frac{1}{7}$ in length of head; tips of anterior rays of dorsal reaching beyond tips of posterior rays when the fin is deflexed, and reaching almost to base of caudal fin. Ventrals rather short, $4\frac{3}{4}$ in length of body, their tips reaching slightly past origin of anal fin. Origin of ventrals midway between pupil and last caudal vertebra. Anal fin opposite dorsal. Lower lobe of caudal rather short, slightly longer than head. Color blue above; silvery below. Pectorals (dusky in the young) becoming nearly white in the adult; color of ventrals very similar to pectorals, the duskiness in the young formed of fine blackish dots. Upper half of anterior rays of dorsal fin black. Anal fin with few small black dots, more numerous in the young; caudal dusky reddish.

GENUS III.—HALOCYPSELUS.

HALOCYPSELUS, Weinland, Proc. Bost. Soc. Nat. Hist., 1859. 385 (*"mesogaster"** Weinland = *evolans.*)

This genus is distinguished from *Exocœtus* chiefly by the small size and anterior position of the ventrals. There are probably but two species, one of them, *H. evolans*, being the most widely distributed of all the flying fishes; the other, *H. holubi* Steindachner, is known only from the west coast of Africa. This species differs from *H. evolans* chiefly in the much higher dorsal.

ANALYSIS OF SPECIES OF HALOCYPSELUS.

a Origin of ventral fins midway between tip of snout and last ray of anal; length of ventrals half length of head. Pectorals $1\frac{1}{3}$ in length of body, their tips reaching base of caudal; first ray of pectoral simple; second divided. Anal fin long, scarcely shorter than dorsal, its first ray usually opposite to first ray of dorsal. Dorsal low, its first ray less than half head. Lower lobe of caudal about one-fourth longer than head. Snout rather blunt, $4\frac{1}{2}$ in head; interorbital area flattish, 3 in head. Eye $3\frac{3}{5}$ in head. Head 4 in length; depth $5\frac{1}{3}$. D. 13; A. 13. Scales about 42. Pectoral fins dark above, with the lower margins white; no white oblique cross-bar. Ventrals white. Caudal dusky. Dorsal and anal pale, without black markings; a white streak along base of anal, wider and more conspicuous anteriorly .... EVOLANS, 3.

*Although Dr. Weinland refers to *E. mesogaster* as the type of *Halocypselus*, it is evident from his description that he had *E. evolans* in mind. He says: "In *E. mesogaster* the ventrals are very short, about one-fourth as long as the pectorals, and placed anterior to the middle of the body, between the anus and the pectorals; the shape of the lower jaw is also angular." For the *mesogaster*, thus diagnosed, he proposes a new genus, *Halocypselus*.

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3. Halocypselus evolans.

Exocœtus, pinnis ventralibus brevissimus, Gronow, Zoöphylac., 358 (Spain).

Exocœtus evolans, Linnæus, Systema Naturæ, xii, 1766, 521 (based on Gronow); Gmelin, Systema Nat., 1789, 1400 (copied); Bloch, Ichthyol., 9, pl. 398. Walbaum, Artedi, Pisc., 1792, 49 (copied); Bloch & Schneider, Syst. Ichth., 1801, 43, pl. 84; Shaw, General Zoology, v, 1804, 144, f, 117; Turton, Linnæus, 1806, 867 (copied); Cuvier & Valenciennes, xix, 1846, 138; (Mediterranean Sea; Brittany; Morbihan; Newfoundland; Antilles; Bahia; Rio Janeiro; Ceylon; Arabia; Cape Verde; New Zealand; New Holland, &c.); Günther, vi, 1866, 282 (Mediterranean; Demerara; Zanzibar; Seychelles; Java; India; China; Australia); Steindachner, Icthyol. Berichte, 1868, 68 (Taragona); Lütken, Vidensk. Meddel. Nat. Foren, 1876, 395, 102 (many seas); Day, Fish. Great Britain, 1883, 126, pl. 129.

Halocypselus evolans, Gill, Rept. U. S. Fish Comm., 1872–'3; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1878, 283 (Beaufort, N. C.; no descr.); Jordan & Gilbert, Syn. Fish N. A., 1883, 377.

Exocœtus volitans, Lacépède, Hist. Nat. Poiss., v, 1798, 401, pl. 12, f. 2; Yarrell, Hist. Brit. Fishes, 1836, 398, ed. 2, 433 (British Channel); Bennett, Whaling Voyage, ii, 1840, 284. (Not of Linnæus).

Exocœtus splendens, Abel, Narr. Voyage China, 1818, 4 (*fide* Val.).

? *Exocœtus georgianus*, Cuv. & Val., 1846, xix, 139 (5° S., 92° W.); Günther, vi, 1866, 279 (copied); Lütken, Vid. Medd. Nat. Foren, 1876, 394, 101 (west of Sandwich Islands 31° S., 47° E.). (Young examples, with barbel.)

? *Exocœtus monocirrhus*, Richardson, Ichth. China, 1846, 265 (China); Günther, vi, 1866, 279 (copied). (Young examples, with barbel.)

Exocœtus chilensis, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 472 (Chili).

Exocœtus obtusirostris, Günther, vi, 1866, 283 (Cape Verde Islands; India; New Orleans); Lütken, Vid. Medd. Naturh. Foren, 1876, 395 (many seas); Steindachner, Beiträge, Kenntniss Fische Afrika's, 1881, 38 (Gaboon).

Halocypselus obtusirostris, Jordan & Gilbert, Syn. Fish N. A., 1883, 378 (copied).

Habitat.—Warm seas; cosmopolitan.

Of all the flying-fishes this species seems to have the widest range, and it is the one most common in collections.

We are unable to distinguish the *obtusirostris* of Günther from *evolans*, the characters assigned to the former by Lütken, as well as those mentioned by Günther, seeming to come within the range of individual variations. The two forms have the same geographical range, and Lütken remarks that "although in most cases it is easy enough to decide to which species any specimen belongs, yet there are some in which this determination seems to be almost arbitrary; therefore I am not fully convinced of their specific independence."

The *chilensis* of Abbott is unquestionably *evolans*. The type is still preserved in the museum of the academy at Philadelphia, where it has been examined by us. The fin rays are D. 14, A. 13, not "D. 16," "A. 15," as stated by Dr. Abbott.

None of the numerous young examples examined by us show any trace of barbels at the chin. It is, however, not impossible that other

young individuals may be found still retaining these appendages. Lütken observes that *E. georgianus* Cuv. & Val. should "have its place beside *E. evolans* and *E. obtusirostris*, but it differs in this respect, that it is provided with barbels; it is even a question if the examples which have lost these could be distinguished from the species above-named."

As none of the specimens of *E. georgianus* examined by Dr. Lütken exceed $2\frac{3}{4}$ inches in length, we regard them, in view of what we already know of the loss of these appendages in *furcatus* and *mesogaster*, as, without much doubt, young individuals of *evolans*.

The "*monocirrus*" of Richardson is, according to Lütken, undoubtedly identical with *E. georgianus*.

The color of very young specimens of *evolans*, less than $1\frac{1}{2}$ inches in length, is bluish above, silvery below. There is a brownish band across the body at base of caudal fin; a second band around body covers posterior half of dorsal and fins; some black on ventrals and on posterior half of pectorals.

In a larger specimen there are no bands on the body, the ventrals are white and the pectorals mostly dark. The length of the pectoral bears about the same proportion to the length of the body in both old and young specimens. The same is true of the proportionate length of the first and second rays of this fin.

Specimens of $\frac{3}{4}$ inch to 9 inches in length are in the museum of the Philadelphia Academy. These are from the Atlantic and Indian Oceans, the Bahamas, the Sandwich Islands, and from Chili. We have examined others from North Carolina and the West Indies.

Genus IV.—EXOCŒTUS.

Exocœtus.

Exocœtus, Artedi, Genera Piscium, 6, 1738 (*volitans*).
Exocœtus, Linnæus, Systema Naturæ, ed. x, 1758, 316 (*volitans*).
Cypselurus, Swainson, Class'n Fishes, etc., ii, 1839, 296 (*nuttalli*).

This group includes most of the species of flying-fishes. Its species are in general larger in size than those of the other groups, and their wing-like paired fins are more extensively developed. As already stated, we regard *Cypselurus* as unworthy of consideration as a genus, the barbels being in most cases, and probably in all, characteristic of young fishes.

ANALYSIS OF SPECIES OF EXOCŒTUS.*

a. Anal fin long, its base a little less than that of the dorsal, its first ray nearly opposite first ray of dorsal; rays of anal 11 to 12.
  b. Second ray of pectoral simple (as well as the first); third ray divided; fourth and fifth rays longest.

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* We here omit (No. 12) *E. cyanopterus* and its doubtful synonym, *E. albidactylus*, the descriptions of both being incomplete.

c. Second ray of pectoral about as long as first ray; ventral fins inserted midway between posterior margin of eye and base of caudal (*i. e.*, end of last caudal vertebra); ventral fins $2\frac{1}{8}$ in length of body, their tips reaching base of caudal; dorsal high, the longest rays about $1\frac{1}{2}$ in head; pectoral fins reaching base of caudal, $1\frac{1}{8}$ in length. Head, 4 in length; depth, $5\frac{1}{2}$; scales about 48; eye, $2\frac{1}{8}$ in head. Pectorals and ventrals marbled with black and white; dorsal fin with a black spot on upper part of anterior rays; anal white; a dusky blotch at base of caudal ....EXILIENS, 4.

cc. Second ray of pectoral about half longer than first; ventral fins inserted midway between middle of preopercle and last caudal vertebra; ventrals $3\frac{1}{2}$ in body, their tips reaching last rays of anal; length of pectorals $1\frac{3}{8}$ in body, their tips reaching nearly to base of caudal fin; first ray of pectoral about half length of longest ray; dorsal moderate, its longest rays $2\frac{2}{3}$ in head; head $4\frac{1}{2}$ in length of body; depth $5\frac{1}{2}$. D. 11; A. 11 or 12. Scales 50: 25 before ventrals and 28 before dorsal. Snout short and blunt, 4 in head; eye $3\frac{2}{3}$; interorbital space $2\frac{1}{2}$. Pectoral fins uniform dusky, with paler edgings. Ventrals nearly black mesially, darker on their posterior half; no black markings on dorsal and anal fins.......................RONDELETI, 5.

bb. Second ray of pectoral divided; first ray simple; third and fourth longest.

e. Origin of ventrals midway between posterior margin of orbit and last caudal vertebra; ventrals chiefly black; pectorals $1\frac{4}{7}$ in body, reaching last ray of dorsal; ventrals about 3 in length of body, their tips reaching slightly beyond last ray of anal; longest dorsal ray $2\frac{1}{2}$ in head; lower lobe of caudal $3\frac{1}{2}$ in body; head $4\frac{1}{8}$ in length; depth, $6\frac{1}{3}$. D.11; A. 12. Scales about 48: 24 before ventrals, 28 before dorsal, 7 between dorsal and lateral line. Snout $4\frac{1}{3}$ in head; eye, 3; interorbital area nearly flat, $2\frac{3}{4}$ in head. Pectoral fins dusky, nearly uniform, or with a small white oblique bar, which extends half way across the fin; the edges of the fin whitish; ventrals chiefly blackish; dorsal and anal without dark markings ....VINCIGUERRÆ, 6.

ee. Origin of ventrals midway between posterior margin of preopercle and last caudal vertebra; ventrals pale, with a dusky shade in the axil.

f. Pectoral fins not uniform in color, dark brown, with an oblique, whitish bond which begins in the axil and runs obliquely backward to middle of fin; edges of pectorals whitish. Pectoral fins $1\frac{3}{5}$ in length of body, their tips reaching beyond dorsal. Ventrals $3\frac{1}{2}$ in body, reaching about to ninth ray of anal; longest dorsal ray $2\frac{1}{2}$ in head, anal ray 3; lower lobe of caudal $3\frac{1}{5}$ in body. Head $4\frac{1}{4}$ in body; depth, $6\frac{1}{5}$. D. 12; A. 11. Scales, 55: 25 before ventrals; 30 before dorsal; 6 rows between dorsal and lateral line. Snout rather obtuse, 4 in head; eye large, $2\frac{3}{4}$ in head; interorbital space slightly concave, $2\frac{2}{3}$ in head; width of body at base of pectorals $1\frac{3}{4}$ in head; ventral fins white, with a slight dusky shade in the axil; no dark markings on dorsal or anal.................................VOLITANS, 7.

ff. Pectoral fins nearly uniform brownish, without oblique pale bar. Length of pectorals, $1\frac{5}{11}$ in body, their tips scarcely reaching last ray of dorsal. Ventrals, $3\frac{1}{2}$ in body, scarcely reaching last ray of anal. Head, $4\frac{1}{6}$ in length; depth, $5\frac{3}{4}$. D. 11, A. 12. Scales about 58; 27 before ventrals, 30 before dorsal; 6 rows between lateral line and dorsal. Snout rather long, equal to eye, $3\frac{1}{2}$ in head. Interorbital area flat, 3 in head. Ventrals scarcely dusky, without distinct markings; dorsal and anal plain....RUFIPINNIS, 8.

aa. **Anal fin short, its base one-half to two-thirds length of base of dorsal; its insertion behind first ray of dorsal; its rays 9 or 10.**

h. Second ray of pectoral divided (first simple); third and fourth rays longest.

i. Pectoral fins without round dark spots.

j. Ventral fins inserted about midway between pupil and last caudal vertebra.

k. Dorsal and anal fins without black markings; ventrals pale.

l. Base of anal $1\frac{3}{8}$ in base of dorsal; pectoral $1\frac{4}{9}$ in length, reaching last ray of dorsal; ventrals $2\frac{3}{4}$ in body, reaching last ray of anal; snout, $3\frac{3}{4}$ in head; eye, $3\frac{1}{5}$. Head, $4\frac{3}{8}$ in body; depth, $5\frac{1}{8}$. Scales, 58: 26 before ventrals, 33 before dorsal, 7 rows of scales between dorsal and lateral line; D. 14, A. 9. Lower lobe of caudal about $\frac{1}{4}$ longer than head. Pectoral fins with an oblique white band across lower half of fin; dorsal and anal plain; ventrals white, their axil scarcely dusky ....HETERURUS, 9.

ll. Base of anal 2 in base of dorsal; length of pectorals $1\frac{2}{5}$ in length of body, their tips reaching end of dorsal fin; length of ventrals $2\frac{8}{9}$ in body, their tips nearly reaching last ray of anal; last ray of anal opposite last of dorsal; lower lobe of caudal about $\frac{1}{4}$ longer than head; snout little pointed, $4\frac{1}{2}$ in head. Eye, $2\frac{3}{4}$: scales 50; 23 before ventrals; 28 before dorsal; seven rows of scales between dorsal and lateral line. Head $4\frac{1}{4}$ in length; depth $5\frac{1}{5}$. D. 14, A. 9. Interorbital area flat; 3 in head. Pectorals black on posterior half; paler on anterior half, with an oblique white bar, which begins in axil and extends two-thirds distance across the fin; edge of pectorals white; ventrals white; the axil a little dusky; dorsal and anal plain; caudal dusky, with a dusky vertical shade across middle rays.....................ROBUSTUS, 10.

kk. Dorsal and anal fins marked with black; dorsal with one or more dark blotches; anal with a black spot on tips of third to sixth rays; ventrals black, with pale edgings, and a white spot near its base; pectorals black, with a white band running from axil obliquely backward to tips of upper rays; caudal with three dusky cross-bars. Pectorals long, $1\frac{2}{9}$ in body, not quite reaching last dorsal ray; ventrals $2\frac{1}{4}$ in body, their tips nearly reaching base of caudal; lower lobe of caudal $3\frac{1}{2}$ in head. Head $4\frac{1}{2}$ in length; depth $5\frac{1}{4}$. D. 13, A. 9. Scales about 46; 8 rows between dorsal and lateral line...FURCATUS, 11.

jj. Ventral fins inserted midway between posterior margin of preopercle and last caudal vertebra. Pectorals not uniformly colored; posterior half of pectorals, ventrals, and dor-

sal rather abruptly black; anal white. Length of pectoral fin $1\frac{1}{5}$ in body, its tip reaching nearly to base of caudal; first ray of pectoral $1\frac{4}{5}$ in length of longest; ventrals $2\frac{2}{5}$ in length of body, their tips reaching tip of last ray of anal; dorsal rather high, its longest rays $1\frac{1}{8}$ in head; longest anal ray $3\frac{1}{2}$ in head; lower lobe of caudal about $\frac{1}{4}$ longer than head. Head $4\frac{1}{4}$ in body; depth $5\frac{2}{3}$. D. 14, A. 9. Scales about 52: 27 before the ventral fins; 26 in front of dorsal. Snout 4 in head; eyes $3\frac{1}{4}$ in head; interorbital space broad, slightly concave, its width $2\frac{2}{3}$ head; depth of head $1\frac{3}{5}$ in its length.... NIGRICANS, 13.

jjj. Ventral fins inserted at a point midway between middle of opercle and last caudal vertebra (or between tip of snout and tip of upper lobe of caudal).

m. [Dorsal fin with a large blackish blotch; pectorals nearly uniformly dusky; ventrals bluish white. Tip of pectotorals reaching end of dorsal; tip of ventrals reaching middle of anal; insertion of ventral midway between tip of snout and that of upper lobe of caudal; dorsal fin of medium height inserted much in advance of anal. Snout $\frac{2}{3}$ length of eye, which is $3\frac{1}{5}$ in head. Head $5\frac{1}{8}$ in total length (with caudal); depth $6\frac{1}{2}$. D. 13, A. 9 or 10. Scales 50.] (*Günther.*) .... BAHIENSIS, 14.

mm. Dorsal fin pale, somewhat dusky above, without distinct black blotch; ventrals mesially blackish, the margins paler; dorsal rather pale, somewhat dusky above; pectorals mostly dusky, with the posterior edges paler; an obscure oblique pale band across lower part. Pectorals $1\frac{2}{7}$ in length of body, their tips reaching caudal fin. Ventrals $3\frac{3}{4}$ in body, their tips reaching middle of anal. Lower lobe of caudal about one-third longer than head. Head $4\frac{4}{5}$ to 5 in length of body; depth, 6. D. 12, A. 10. Snout, 4 in head. Eye, $3\frac{1}{3}$ in head. Base of anal, $1\frac{2}{3}$ in base of caudal. Scales, about 60..CALIFORNICUS, 15, 16.

ii. Pectoral fins covered with small round dark spots; the edges paler; ventral fins pale, the middle rays grayish, obscurely spotted; other fins pale. Pectoral fins reaching to end of dorsal; ventral fins inserted midway between preopercle and base of caudal, their tips reaching nearly to base of anal. Dorsal fin rather high, its anterior rays about half length of head. Distance between first dorsal ray and first rudimentary ray of caudal equal to length of head. Scales, 46: 34 before the dorsal fin, and 9 between lateral line and dorsal fin. Head nearly 4 in length (to base of caudal); depth, 5. D. 11 or 12, A. 8. Snout obtuse and depressed, three-fifths diameter of eye, which is 3 in head, and less than width of interorbital space, which is slightly concave ...... CALLOPTERUS, 16.

hh. Second ray of pectoral simple (like the first); third ray divided.

n. Snout more obtusely descending than in any other species, its length $4\frac{1}{2}$ in head; eye 3 in head; interorbital area slightly concave, about $\frac{1}{4}$ wider than eye; ventrals inserted midway between posterior margin of orbit and last caudal vertebra; their length $2\frac{2}{10}$ in body, their tips reaching last ray of anal; pectorals $1\frac{2}{5}$ in body, their tips

reaching last ray of dorsal. Head 4 in length; depth $5\frac{1}{3}$. D. 12, A. 9. Scales 46. Pectoral fins dusky, darker towards their tips; ventrals dusky, nearly black mesially, paler towards the edges; dorsal and anal without dark markings; caudal dusky; a faint dark streak along each row of scales on upper part of body.....GIBBIFRONS, 17.

4. Exocœtus exiliens.

Exocœtus exiliens, Gmelin, Systema Naturæ, 1788, 1400 (Carolina); Turton, Linnæus, 867, 1806. (Copied.)

? *Exocœtus exiliens*, Cuv. & Val., 1846, xix, 114 (New Jersey); ? Günther, vi, 1866, 291. (Copied.)

Exocœtus exsiliens, Walbaum, Artedi, Piscium, 1792, 50. (Copied.)

Exocœtus fasciatus, Le Sueur, Journ. Acad. Sci. Phila., 1821, 10, pl. 4, f. 2. (Atlantic.)

Exocœtus lamellifer, Kner & Steindachner, Neue Fische. Mus. Godeff., 1866, 29. (12° S., 33° W.); Lütken, Vidensk Meddel. Naturh. Foren., 1876, 405, 11. (Atlantic, Indian, and Pacific Oceans.)

Habitat.—Atlantic, Indian, and Pacific Oceans.

Head 4 in length of body; depth $5\frac{1}{2}$; D. 11; A. 11; 48 scales in lateral line. Body little compressed, angulated. Head broad; interorbital space slightly concave; snout rather blunt, short, $4\frac{2}{3}$ in length of head; interorbital area $2\frac{1}{4}$ in head; eye $2\frac{1}{3}$ in head; lower jaw slightly longer than upper.

Pectorals long and broad, $1\frac{1}{3}$ in length of body, their tips reaching base of caudal. First two rays of pectoral simple and of equal length, their length $2\frac{1}{3}$ in length of fin, and connected to each other and to third ray by rather broad membranes.

Ventrals long, $2\frac{1}{3}$ in body, their tips reaching base of caudal fin.

Origin of ventrals midway between posterior margin of orbit and last caudal vertebra. Last rays of dorsal and anal fins opposite each other. Base of anal slightly shorter than that of dorsal. Dorsal rather high, its longest ray $1\frac{2}{5}$ in head; longest ray of anal $1\frac{3}{4}$ in head.

Color brownish above, silvery below. Pectorals and ventrals marbled with black. Dorsal with a black spot on upper part of its anterior rays. Lower caudal lobe with a black spot about $\frac{1}{3}$ distance from its base. Breast with three black cross-bands. Anal fin white.

The above description is taken from a single specimen in the museum of the Philadelphia Academy. It is $2\frac{3}{4}$ inches in length, and was obtained by Mr. W. H. Jones at 31° 30′ N., 36° 36′ W., during a cruise of the Constitution.

We regard this species as, with little doubt, the original *Exocœtus exiliens* of Gmelin. Gmelin's species is evidently one of those with long anal and with the fins banded with black. The first and second rays of the pectoral are said to be both short, a character which distinguishes this species at once from *E. rondeleti*.

The following is Gmelin's description:

Exiliens. 3. E. pinnis ventralibus caudam attingentibus. D. 10, P. 15, V. 6, A. 11, C. 20

"Habitat ad Carolinam, volitanti statura simillimus, at vix digito longior, neque argenteus. Garden.

"Pinnæ pallidæ, fascia una alterave nigricante, ventrales, quæ in volitante ne anum quidem attingunt, apice pinnam caudæ attingentes, $\frac{1}{4}$ a cauda remotæ, ceterum, uti in volitante, inter caput et anum mediæ, radio primo brevi, pectorales radio primo et secundo brevibus; caudalis lobus inferior longior."

The specimen examined by us agrees very closely with the description and figure of *lamellifer* given by Kner and Steindachner. It agrees also with Lütken's account of the same species.

The *fasciatus* of Le Sueur seems to be, in all probability, the same fish. The figure is very poor, and the description meager, but apparently one of the species with long anal is indicated, probably *exiliens* rather than *volador*, especially as the first and second pectoral rays are figured as nearly equal in length.

All the known specimens of *exiliens* are young fishes, and it is barely possible that *E. rondeleti* is the adult of the same species. The differences in the length of the second ray of the pectoral and in the height of the dorsal seem, however, hardly likely to be due simply to differences of age. The *Exocœtus exiliens* of Cuvier & Valenciennes is indeterminable from the description. It may be the young of *E. exiliens*, *rondeleti* or *vinciguerræ*. *Exocœtus nigripinnis* and *E. brachycephalus* Günther seem to be closely allied to *E. exiliens* and *E. rondeleti*.

5. Exocœtus rondeleti.

Mugil alatus, Rondelet, De Piscibus, ix, 207, 1554.

Exocœtus rondeleti, Cuv. & Val., xix, 115, 1846 (Naples, Sicily, Canaries); Günther, 1866, 293 (copied); Steindachner, Ichthyol. Bericht., 1868, 69 (east coast of Spain, Sicily, Triest); Vinciguerra, Risultati Ittiologici del Violante, 1883, 110 (Malta, Toulon, Tripoli, Lipari, Naples, Genoa, Nice).

? *Exocœtus brachycephalus*, Günther, vi, 1866, 297. (China.)

Exocœtus brachycephalus (in part ?), Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 110, 405 (Atlantic, Nice, Acapulco, &c.).

? *Exocœtus exiliens*, Goode, Bull. U. S. Nat. Mus., v, 64, 1875 (Bermudas); Jordan & Gilbert, Syn. Fish. N. A., 1883, 380 (copied).

Exocœtus volador, Jordan, Proc. U. S. Nat. Mus., 1884, 34. (Pensacola.)

Habitat.—Tropical seas, north to Florida and France.

Our specimens agree very closely with Günther's description of *E. brachycephalus*. His species seems, however, to be slenderer than ours (depth $6\frac{1}{2}$ in length), the head shorter (5), and the dorsal much higher (its longest rays more than half head). The specimens noticed by Lütken as *E. brachycephalus* from the Atlantic seem to be the young of this species. The largest of our specimens have (as is stated in the original description of *E. volador*) the first ray of the pectoral about half the length of the fin, the second ray two-thirds. A younger specimen (7 inches) has the first ray of the pectoral about one-third the length of the longest, one-half the length of the second. Lütken finds the first

ray scarcely one-third the longest, the second about one-half the longest, or a little more, and not two-thirds the third ray. This species, then, is subject to some variations in this regard.

We must, then, with Lütken, "leave undecided, for the present, the question of the number of actual species among the forms which group themselves around *E. brachycephalus*."

The *Exocœtus exiliens* of Goode is probably the present species, rather than *E. vinciguerræ* or *E. exiliens.* The second ray of the pectoral is said to extend beyond the membrane in a spine-like process. This apparently implies that it is a simple ray, while the shortness of the first pectoral ray, as compared with the second, precludes the possibility of Professor Goode's specimen having been a true *exiliens.*

We had at first, following Lütken and Bleeker, regarded the following species as the true *rondeleti* of Cuv. & Val., although the description of the latter author applies equally well to the present species.

Dr. Vinciguerra has, however, shown conclusively that the true *rondeleti* must be the species with the second pectoral ray simple, and according to Dr. Sauvage (quoted by Vinciguerra) the original types of the *E. rondeleti* show this character. The name *volador* becomes, therefore, a synonym of *rondeleti.* For a full discussion of the species, which appears to be one of the most common in the Mediterranean, the reader is referred to the "Risultati Ittiologici del Violante" of Dr. Vinciguerra.

The assertion of Moreau (Hist. Poiss. France, iii, 353), that in the same individual the second ray of the pectoral is sometimes entire on one side and split on the other, needs verification.

Of this species we have examined the original type of *Exocœtus volador* 9¼ inches long (34975 U. S. N. M.) from Pensacola, and three specimens in the museum of the Academy. One of these, from the Bonaparte collection, taken in the Atlantic, is 7 inches long; one, 10 inches long, is from the Gulf of Mexico (Dr. J. Carson), and a third, 9 inches long, from the Atlantic. A specimen from near the Island of St. Thomas is in the museum of the High School at Battle Creek, Michigan.

6. **Exocœtus vinciguerræ**, nom. sp. nov. (21870, U. S. N. M.).

> *Exocœtus rondeleti*, Lütken, Vidensk. Meddel. Foren., 1876, 404 (Atlantic); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 263; Jordan & Gilbert, Syn. Fish. N. A., 1883, 904 (open sea, 46° N.; 61° W.); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 263 (not of Cuv. & Val.).
>
> *Exocœtus ? exiliens*, Vinciguerra, Risultati Ittiologici del Violante, 1883, 113 (not of Gmelin).
>
> *Exocœtus vinciguerræ*, nom. sp. nov.

Habitat.—Atlantic.

As already noticed, the description of Cuvier & Valenciennes of their *E. rondeleti* is insufficient for discrimination among the species with long anal and black ventrals. Lütken, Bleeker, and Jordan & Gilbert have applied the name *rondeleti* to the present species, leaving for the other the name "*brachycephalus*" or "*volador.*" Dr. Vinciguerra has, however, shown that the original *rondeleti* is the preceding species,

the *volador* of Jordan. The species with the second ray of the pectoral divided is thus left without a name, and we suggest that of *Exocœtus vinciguerræ* in honor of our excellent friend, the ichthyologist of the Museo Civico at Genoa, who was the first to show the correct application of the name *rondeleti*.

Of this species we have examined three examples. One, which may be regarded as the type of *Exocœtus vinciguerræ* (No. 21870, U. S. Nat. Mus.), is from the open sea south of Newfoundland. Two others are in the museum of the academy. One of these is $6\frac{1}{4}$ inches long, from the Gulf of Mexico (Dr. J. Carson), and the other, $3\frac{1}{2}$ inches long, from St. Martin's (Dr. R. V. Rijgersma).

The young of this species, like that of *E. exiliens*, has the paired fins marbled. The first rays of the pectoral are also separated by a broad membrane in the young of this, as of other species.

7. Exocœtus volitans.

Exocœtus, Artedi, Genera Piscium, 1738, 18, et Syn. Nov. Pisc., 1738, 35 (locality not specified); Balk. Amœnitates Acad. (Mus. Adolph-Friderici), 1, 1749, 603 (after Artedi).

Exocœtus volitans, Linnæus, Syst. Nat., x, 1758, 316 (after Balk.); Linnæus, xii, 1766, 522; Gmelin, Syst. Nat., 1788, 1399 (copied); Turton, Linnæus 1806, 866 (copied).

Exocœtus speculiger, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 1846, 93 (Friendly Islands; Straits of Sunda; Isle of France; Indian Ocean, Peros-Banhos; Pacific coast of South America); Bleeker, "Ned. Tydskr. Dierk. iii, 1865, 122" (Pacific Ocean); Gunther vi, 1866, 287 (Amboyna; Australia); Lütken, Vidensk. Meddel. Naturh. Foren., 1876, 403, 109 (Indian Ocean; Atlantic; Pacific; Arabian Sea; Honolulu; Mediterranean ?); Hutton, Fish. New Zealand, 1872, 55 (New Zealand).

? *Exocœtus noveboracensis*, Cuv. & Val. xix, 1846, 100 (Newfoundland; not of Mitchill).

? *Exocœtus roberti*, Müller & Troschel, Schomburgk's Hist. Barbadoes, 1848, 675 (Barbadoes).

? *Exocœtus quadriremis*, Gronow, Cat. Fish. in Brit. Mus., 1854, 145 (Spain and India).

Exocœtus affinis, Günther vi, 1866, 288 (West Africa; Cuba ?; Atlantic).

Exocœtus melanurus, Jordan & Gilbert, Syn. Fish. N. A., 1833, 379); (not of Cuv. & Val.; specimen from off coast of New England).

Exocœtus exiliens, Jordan & Gilbert, Syn. Fish. N. A., 1883, 904 (same specimen; not of Gmelin); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 263.

Habitat.—Tropical seas: north to New England.

The *Exocœtus volitans* of Linnæus is based on the *Exocœtus* of Artedi. The locality of the specimen described in detail by this author is not stated. There is no evidence that it came from the Mediterranean. It is evident from the numbers of the fin-rays that Artedi's example did not belong to the species called *volitans* by Cuv. & Val. As the rays of the dorsal and anal are each stated to be eleven, the name *volitans* must be reserved for one of the species with the anal fin long. The ventral fins are said to be white, which fact excludes from considera-

tion *exiliens*, *rondeleti* and *vinciguerræ*. We have left for consideration only the present species and *rufipinnis*, and of these, Artedi's species seems much more likely to have been the former than the latter.

The *speculiger* of Cuv. & Val. and the *affinis* of Günther we identify with the present species on the strength of Dr. Lütken's statement that on comparison of specimens, he finds it impossible to separate them. The scantily described *roberti** of Müller & Troschel seems also to be the same. It is a species with long anal and white markings on the pectorals. Presumably it has pale ventrals also, as it is compared by its describers with *E. cyanopterus*, and no difference in this regard is indicated.

The *E. noveboracensis* of Cuv. & Val. is also apparently the present species, but of this we cannot be quite certain.

Specimens of this species from points off our North Atlantic coast are in the National Museum. In the Museum of the Academy is a specimen 11½ inches long, collected by Isaac Tyson in the Atlantic.

8. Exocœtus rufipinnis.

? *Exocœtus exiliens*, Jenyns, Zool. Voy. Beagle, Fishes, 1842, 122 (not of Gmelin).

Exocœtus rufipinnis, Cuvier & Valenciennes, Hist. Nat. Poiss., 1846, 99 (Payta, Peru); Günther, vi, 1866, 294 (copied); Jordan, Proc. Ac. Nat. Sci. Phila., 1884, 283 (redescription of original type).

Exocœtus dowi, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 167 (near Panama).

Exocœtus scylla, Cope, Trans. Am. Phil. Soc. Phila., 1871, 481 (Tobasco, Mexico).

Exocœtus roberti, Lütken, Vidensk. Meddel. Naturh. Forening, 1876, 12, 110 (Barbadoes; not of Müller & Troschel).

Habitat.—Tropical America.

The *Exocœtus scylla* of Cope belongs apparently to a species different from *E. volitans*, and distinguished among other characters by the color of the pectorals.

The *Exocœtus rufipinnis* of Cuv. & Val., too briefly redescribed by Professor Jordan, does not differ from *E. scylla* in any important respect so far as the description goes. The same is true of *Exocœtus dowi*, which is certainly identical with *E. rufipinnis*. The type of *E. dowi* is lost, but a specimen from Panama is in the Academy of Sciences at San Francisco. While it is possible that these few specimens may represent more than one species, it is probable that *scylla*, *rufipinnis*, and *dowi* are the same. The specimen from Barbadoes, called *roberti* by Lütken, distinguished from *E. speculiger* by the uniformly colored pectorals, probably belongs to *E. rufipinnis*.

The following description is taken from the original type of *Exocœtus scylla:*

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*The description of Müller & Troschel is very short. The following is the substance of it: "D. 11, A. 12; this species resembles *E. cyanopterus* Cuv. & Val., but it differs in the dorsal fin, which is much lower and of one color; the pectorals are diaphanous and dark colored, and on the inner part near the base is a large white spot." It is recorded by them as being very abundant about the Barbadoes.

Head, $4\frac{1}{6}$ in length to last caudal vertebra; depth, $5\frac{3}{4}$. D., 11; A. 12; scales of lateral line, 58. Length of specimen, $9\frac{1}{2}$ inches.

Body rather robust, not much compressed; head broad; interorbital area flat, its width 3 in head; eye rather small, its diameter $3\frac{1}{2}$ in head; snout rather blunt, its length equal to diameter of eye; mouth large; length of maxillary $4\frac{1}{4}$ in head.

Pectoral fin broad and long, its length $1\frac{5}{11}$ in length of body; tips of pectorals scarcely reaching the last rays of dorsal fin; first ray of pectoral simple, $1\frac{2}{7}$ in length of fin, second ray divided, third and fourth rays longest.

Origin of ventrals midway between posterior edge of preopercle and last caudal vertebra, their tips scarcely reaching last ray of anal; length of ventrals $3\frac{1}{2}$ in length of body. First rays of dorsal and anal opposite each other (or nearly so); base of anal $1\frac{1}{8}$ in base of dorsal; base of dorsal $1\frac{1}{2}$ in head; lower lobe of caudal long, about one-fourth longer than head, width of body at base of pectorals $1\frac{5}{8}$ in length of head. Least depth of caudal peduncle about $3\frac{3}{8}$ in length of head.

Posterior margin of preopercle nearly vertical, forming almost a right angle at its lower posterior extremity. Gill-rakers long, numerous, and slender.

About twenty-seven scales on lateral line before ventrals; about thirty scales between occiput and dorsal fin; six rows of scales between dorsal fin and lateral line.

Color uniform brownish above, silvery below. Pectorals colored like upper part of body, shading into darker toward their extremities; caudal uniform brownish, no dark markings on dorsal and anal fins; ventrals without distinct black markings.

9. Exocœtus heterurus.

Exocœtes exiliens, Bloch, Ichthyol., taf. 392 (not of L.); Bloch & Schneider, Syst. Ichth., 1801, 429 (in part, copied).

Exocœtus heterurus, Rafinesque, Caratteri di Alcuni Nuovi Generi, etc., 1810, 58 (Palermo).

? *Exocœtus comatus*, Mitchill, Trans. Lit. and Phil. Soc. N. Y., 1815, 448, pl. 5, f. 1 (New York); De Kay, New York Fauna, Fishes, 1842, 231, pl. 36, f. 15 (after Mitchill); Storer, Synopsis Fish. N. A., 1846, 188; Lütken, Vidensk. Meddel. Natur. Foren., 1876, 106, f. 1 (36° W., 11° N.) (apparently a young form, with long mental barbel).

? *Cypselurus comatus*, Gill, Cat. Fish E. Coast, 1861, 38 (name only); Jordan & Gilbert, Syn. Fish. N. A., 1883, 381 (after Lütken).

Exocœtus noveboracensis, Mitchill, Amer. Monthly Mag., ii, 1814, 233 (New York); De Kay, New York Fauna, Fishes, 1842, 230, pl. 36, f. 114 (after Mitchill); Storer, Syn. Fish. N. A., 1846, 188 (copied); Jordan & Gilbert, Syn. Fish. N. A., 1882, 904 (Wood's Holl, Mass.; Pensacola, Fla.).

? *Exocœtus appendiculatus*, Wood, Journ. Ac. Nat. Sci. Phila., 1824, 283, pl. 17, f. 2 (young; S. coast United States).

Exocœtus volitans, Cuv. & Val., xix, 1846, 83, pl. 559 (Toulon; Corsica; Nice; Genoa; Algiers); Günther, vi, 1866, 293 (copied); Steindachner, Ichthyol. Bericht., 1868, 68 (Alicante); Lütken, Vidensk. Medd. Nat. For., 1876, 10, 108 (St. Bartholomew; Gulf of Mexico; Naples; Nice); Doder-

lein, Prospetto Metodico delle Specie Pesci, 1879, 58 (Palermo); Vinciguerra, Risultati Ittiologici del Violante, 1883, 117; Day, Fishes, Great Britain, 1883, 155, pl. 228 (straggler to coast of England).

? *Exocœtus lineatus*, Cuv. & Val., Hist. Nat. Poiss. xix, 1836, 92 (Gorea; Canaries); Günther vi, 1866, 287 (Madeira); Goode, Bull. U. S. Nat. Mus., v, 1876, 76 (Bermudas; no description).

Exocœtus melanurus, Cuvier & Valenciennes, xix, 1846, 101 (New York).

*Exocœtus affinis**, Cope, Trans. Amer. Phil. Soc., 1871, 481 (St. Martin's; no description).

Habitat—Atlantic Ocean, north to New York.

We have identified the common *Exocœtus noveboracensis* of our Atlantic and Gulf coast with the *Exocœtus volitans* of Cuv. & Val., as it agrees in all respects with their description, and also as Lütken affirms the identity of specimens from the West Indies with others from the Mediterranean. The *Exocœtus volitans* of Linnæus cannot, however, be the same species, as already noticed, because Artedi, on whose account the species is based, enumerates eleven dorsal and eleven anal rays. The *Exocœtus melanurus* of Cuv. & Val. seems to be the present species, as has been already noticed by Jordan & Gilbert. *Exocœtus lineatus* of Cuv. & Val. and Günther is closely allied to this species, but it may possibly be distinct.

We have also referred to the synonymy of this species the bearded *comatus* of Mitchill and other authors. It appears to differ from *E. heterurus*, only in the presence of a long ribbon-like barbel at the chin. This is certainly a character of youth, and if the barbel were lost we do not see how *comatus* could be distinguished from *heterurus*.

We have, however, not examined any bearded examples of this species, and draw our knowledge of *comatus* chiefly from Lütken's figure. The *appendiculatus* of Wood seems to be identical with *comatus*.

The oldest name of this species seems to be that of *heterurus*,† Rafi-

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*The specimen noted by Professor Cope is in the museum of the Academy. It has the dorsal inserted much before front of anal. D. 13, A. 10.

† "The following is Rafinesque's original description:

"156. Sp. *Exocœtus heterurus.*—Ale pectorali giungendo quasi alla coda e con 10 raggi, l'adominali situati più vicino della coda che del capo, ma non giungendo fino ad essa, lobo inferiore della coda più lungo, ala dorsale con 14 raggi, l'anali con 10. *Rondinone* Mong. Sic. ric, 2, p. 90. *Oss.* Questo pesce è abondantissimo nel golfo di Palermo nell' autunno mentre l'*E. exiliens* raramente visi vede, va allora in gregia nuotando e svolazzando a fiore d' acqua, e si pesca copiosamente con i palangari, onde alcune volte anche si sala; e giovani allora, lungo circa di otto pollici e si chiama *Ancileddu*, *Angilettu*, o *Rondenuni;* fra breve tempo abbandona i lidi, fuori alcuni puochi, che vi rimangono, e nella primavera vi ricompare per deporre l'ova ma in minor numero, e non più in turbe; allora è più grosso lungo un piede ed anche più e porta il nome *Ancilone*, si distingue facilmente dall' *E. exiliens* dal numero dei raggi dell ale, sue abdominali più corte, sua coda ineguale, etc., ha il capo depresso al disopra; e mascelle senza denti, con l' inferiore più lunga della superiore, il dorso nero cerulescente, il ventre bianco-argentino, le ale pettorali color di rame al di sotto, con i raggi articolati e biforcati, l' adominale con 6 raggi dichotomi, giungendo un poco al di là dell' ano, la coda ineguale con 15 raggi e col labro superiore più piccolo e più corto dell' inferiore, al fin hà due linei laterali da ogni lato, di cui l' inferiore è molto bassa."

nesque. This name is applied by him to some species with short anal. His description agrees with the present form better than with any other. This species seems to be one of the most abundant in the Mediterranean.

The specimens examined by us are from $9\frac{1}{2}$ to 15 inches in length, and are from the Atlantic and West Indies.

10. Exocœtus robustus.

? *Exocœtus robustus*, Günther, vi, 1866, 289 (Australia).

Habitat.—Tropical seas.

The following description is taken from a specimen in the museum of the academy at Philadelphia:

Head $4\frac{1}{4}$ in length of body; depth $5\frac{1}{5}$; D. 14; A. 9; 50 scales in lateral line; length of specimen 9 inches. Body rather robust. Head broad, rather pointed forwards; snout not very blunt, $4\frac{1}{2}$ in length of head; eye large, $2\frac{3}{4}$ in head; interorbital area flattish, 3 in head. Pectoral fins broad, their tips reaching posterior end of base of anal fin; length of pectorals $1\frac{2}{5}$ in length of body. Length of ventrals $2\frac{8}{9}$ in length of body, their tips reaching nearly to posterior end of base of anal fin; origin of ventrals midway between pupil and base of caudal fin. First ray of pectoral simple, its length little more than one-half length of fin; second ray divided; 23 scales before the ventrals; 28 scales before the dorsal fin; 7 rows of scales between lateral line and dorsal fin; longest dorsal ray 2 in head; lower lobe of caudal about one-fourth longer than head.

Color brownish above, silvery below; pectoral black on its posterior half; lighter on anterior, with a broad, white, oblique band which begins in the axil and extends about two-thirds across the fin; ventrals white, dusky in axil; dorsal and anal fin plain; caudal dusky, with a black vertical bar across the base of its middle rays.

The single specimen from which the above description is taken agrees fairly with Dr. Günther's description of *E. robustus.* That description is, however, too incomplete for us to consider the identification as at all certain. Our specimen is said to be from "Cape San Antonio." Whether the cape in Cuba so named is intended, or some headland elsewhere, we are unable to say.

11. Exocœtus furcatus.

Exocœtus furcatus, Mitchill, Trans. Lit. and Phil. Soc. N. Y., i, 1815, 149 (young, with barbel; New York); De Kay, New York Fauna, Fishes, 1842, 231 (after Mitchill); Cuv. & Val., xix, 1846, 98 (copied); Günther, vi, 1866, 286 (India); Lütken, Vidensk. Meddel. Naturh. Foren., 1876, 400 (Mediterranean; Atlantic; Indian Ocean).

Cypselurus furcatus, Jordan & Gilbert, Syn. Fish. N. A., 1882, 380 (copied).

Exocœtus nuttalli, Le Sueur, Journ. Ac. Nat. Sci. Phila., 1821, 10, pl. iv, f. 1 (Gulf of Mexico); Gunther, vi, 1866, 286 (copied).

Cypselurus nuttalii, Swainson, Nat. Hist. Class'n, Fishes, ii, 1839, 296 (generic diagnosis).

Exocœtus (*Cypselurus*) *procne*, De Fiilppi e Verany, Mem. Acad. Sci. Torino, ser. 2, xviii, 1857, 10, xviii, 5 (Nice).

Exocœtus maculipinnis, Vinciguerra, Risultati Ittiologici del Violante, tav. i, f. 6, 1883, 113 (Tunis).

Habitat.—Warm seas, north to New York, and the Mediterranean.

Of this species we have examined three specimens, all of them in the museum of the academy at Philadelphia. The smallest of these ($3\frac{1}{4}$ inches long; Atlantic; Bonaparte collection) is a typical *furcatus*, having at the chin two ribbon-like appendages, one attached to each side of the mandible a short distance from the symphysis. These barbels are a little shorter than the eye; they are black on their distal half. This specimen agrees well with the figure of De Filippi and Verany above cited (*E. procne*).

The two larger examples (one $5\frac{1}{2}$, the other 6 inches in length, both collected at Newport, R. I.) agree with the smaller one in all respects except that they show no traces of barbel. We are compelled to believe them the adult of *furcatus*, which species, therefore, loses the barbels with age. As this is certainly true in *Parexocœtus mesogaster* also, we feel justified in regarding all bearded *Exocœti* as immature individuals.

We have placed, with Lütken, the *E. nuttalli* in the synonymy of *E. furcatus*. In Le Sueur's figure of *E. nuttalli* the barbels are represented as trilobate and as being attached near the angle of the mouth. They are also figured as longer than the head, but this may be true in a very young specimen, such as Le Sueur had before him. The coloration is that of the young of this species. and of several others.

The specimen described and figured by Vinciguerra as *Exocœtus maculipinnis* agrees in all essential respects with the two larger (beardless) examples, which we refer to *E. furcatus*. We therefore regard it as belonging to this species, and as representing a form more mature than the "*procne*" and "*furcatus*," the "*nuttalli*" being a still younger form of the same.

The following description is drawn up from the two specimens from Newport:

Head $4\frac{1}{2}$ in length to end of last caudal vertebra; depth $5\frac{1}{4}$; D. 13; A. 9; lateral line with about 46 scales; length of specimens 6 and $5\frac{1}{2}$ inches. Body rather slender, compressed. Head not very broad, much narrowed forward; the snout rather pointed; head more compressed than in other species. Interorbital area flat; its width at anterior margin of orbit equal to diameter of eye; 3 in head; at posterior margin of eye this is half greater. Mouth small; maxillary not reaching orbit; length of maxillary $4\frac{2}{3}$ in head; length of mandible $2\frac{1}{2}$ in head; length of snout $4\frac{1}{5}$ in head; eye 3 in head. Pectoral fin long and broad; its length $1\frac{2}{5}$ in length of body; tips of pectorals reaching to tenth ray of dorsal. First pectoral ray simple; slightly more than half length of fin; second ray divided; third and fourth rays longest. Origin of ventrals midway between posterior margin of eye and last caudal vertebra. Ventrals long; $2\frac{1}{4}$ in length of body; their tips reaching past anal and almost to caudal fin. Dorsal fin rather high; its longest ray $1\frac{1}{2}$ in head; longest anal ray about 2 in head. Origin of dorsal in advance of that

of the anal. Base of anal $1\frac{3}{8}$ in base of dorsal; base of dorsal nearly equal to length of head. Lower lobe of caudal $3\frac{1}{2}$ in body. About 23 scales on lateral line before ventrals, and about 29 in front of dorsal fin. Eight rows of scales between lateral line and dorsal fin. Color brownish above; silvery below. Pectoral fins black on lower posterior half; a broad white band running from axil obliquely back to the posterior of upper rays; some white on tips of pectoral rays. Anterior upper portion of the fin somewhat marbled. Ventral fins black, except on two outer rays, on inner ray, and a small spot on next two inner rays about one-fourth distance from origin of fin. Axil of ventrals pale. Dorsal fin, when depressed, showing three black spots; caudal fin with three dark transverse bands across fin; a black spot on tips of third, fourth, fifth, and sixth rays of anal fin.

12. Exocœtus cyanopterus.

Exocœtus cyanopterus, Cuv. & Val., xix, 1846, 98 (Bahia; Rio de Janeiro); Günther, vi, 1866, 294 (copied).

? *Exocœtus, albidactylus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 167 (Caribbean Sea, north of Brazil; erroneously ascribed to Panama).

Habitat.—Coast of Brazil.

We know nothing of this species except what is contained in the meager description of Valenciennes. In its coloration it approaches *E. bahiensis*, but the statement "D. 13, A. 12" would indicate that its place is in the group with the anal fin long, in the neighborhood of *E. volitans* and *E. rufipinnis*. From the latter it differs by the presence of a large black blotch on the dorsal.

We place here with doubt also the *E. albidactylus* of Gill, which seems to agree with *E. cyanopterus* except in the number of its fin rays ("D. 14, A. 10"). Possibly either Gill or Valenciennes has made an error in counting. The description of *E. albidactylus* indicates some resemblance to *E. bahiensis*, but the insertion of the ventrals, according to Gill's description, would be farther forward, much as in *E. furcatus*.

The type of *E. albidactylus* seems to be lost. Captain Dow, who collected it, has informed Professor Gilbert that it was taken in the Caribbean Sea, north of Brazil, and not at Panama.

13. Exocœtus nigricans.

Exocœtus nigricans, Bennett, Whaling Voyage, ii, 1840, 287; Günther, 1866, vi, 290 (Java).

Exocœtus bicolor, Cuv. & Val., xix, 1846, iii (Atlantic); Bleeker, "Ned. Tydschr. Dierk., iii, 132."

Exocœtus spilopus, Cuv. & Val., xix, 1846, 118. (La Rochelle, St. Helena, West Indies, India, Arabia, De Witt Land); Guichenot, Hist. Cuba. Ramon de la Sagra, Poiss., 1853, 152, pl. 4, f. 2 (Cuba); Lütken, Vid, Med. Nat. For., 1876, 107 (Indian Ocean).

Habitat.—Tropical seas, north to France.

This species is one of the most easily recognized in the group. It may be known at sight by the high dorsal fin, black on its posterior half, the posterior half of the ventral being also black.

Lütken has preferred the name *spilopus* to that of *nigricans*, because "it is not certain that the *nigricans* of Bennett, in which the black spot on the ventrals is situated at its base and not towards its extremity, is the same species." This element of doubt seems to us very slight. The *bicolor* is probably the same species, with the black on the ventrals faded into grayish blotches.

A specimen 10 inches long is in the museum of the academy from 18° S., 34° W. One, said to be from Central America, is in the National Museum.

14. Exocœtus bahiensis.

Exocœtus bahiensis, Ranzani, "Nov. Comm. Acad. Sci. Inst. Bonon., v, 1842, 362, tab. 38" (Brazil); Günther, vi, 1866, 293 (Sumatra; Atlantic); Poey, Synopsis Pisc. Cub., 1868, 384, 385 (Cuba); Poey, Enum. Pisc. Cub., 1875, 121 (Cuba); Lütken, Vid. Medd. Naturh. Foren., 1876, 402, 108 (Indian Ocean).

Exocœtus vermiculatus, Poey, Memorias Cuba; ii, 1861, 300 (Cuba).

Exocœtus spilonotopterus, Bleeker, "Nederl. Tydschr. Dierk., iii, 1863, 113" (Sumatra).

? *Exocœtus parræ*, Poey, Syn. Pisc. Cub., 1868, 385; Poey, Enum. Pisc. Cub., 1875, 122. (Description insufficient; taken from an old drawing.)

Habitat.—Tropical seas; north to Cuba.

We have not studied this species. It is apparently closely related to *E. furcatus* and *E. nigricans*, differing from the former, so far as we know, in the coloration of its paired fins. From *E. nigricans* it further differs in the coloration of the dorsal fin.

Exocœtus parræ Poey, described from an old drawing, is too little known to be admitted as a species, or to receive any definite place in the synonymy.

The *Hirundo* of Catesby and the *Volador* of Parra are rough drawings of flying fishes, not recognizable as to the species.

15. Exocœtus californicus.

Exocœtus californicus, Cooper, Proc. Cal. Acad. Sci., iii, 1864, 93, f. 20 (Santa Catalina Island); Günther, vi, 1866, 295 (copied); Jordan and Jouy, Proc. U. S. Nat. Mus., 1881, 13 (Santa Barbara); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 42, 457 (Santa Barbara, Santa Catalina, San Pedro, San Diego); Rosa Smith, Fishes San Diego, 1882 (Coronados Islands; no description).

Habitat.—Coast of Southern California.

Upwards of 400 examples of this species were obtained by Professors Jordan and Gilbert off Santa Barbara and San Pedro. In this region it is extremely abundant at the spawning season in the summer. It has not been recognized in any other locality nor at any other season. Its young is unknown. All the known examples are similar in size, 16 to 17 inches in length. It is probably the largest in size of all the flying fishes. It may be readily distinguished by the absence of distinct color markings and by the backward position of the ventrals.

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Vol. VIII, No. 5. Washington, D. C. ~~April 23~~, 1885.

16. Exocœtus callopterus.

Exocœtus callopterus, Günther, vi, 1866, 292 (Panama); Günther, Fishes Central Amer., 1869, 479, pl. 83 (Panama); Lütken, Vidensk. Meddel. Naturh. Foren., 1876, 401, 107 (Panama).

Exocœtus calopterus, Jordan & Gilbert, Bull. U. S. Fish Comm., 1882, 109 (Panama).

Habitat.—Pacific coast of tropical America; Panama.

This species was found in some abundance at Panama by Professor Gilbert. It is one of the most strongly marked forms, readily distinguishable from other American species by the color of the pectorals. It needs further comparison with certain East Indian species which have the pectoral fins similarly marked.

17. Exocœtus gibbifrons.

Exocœtus gibbifrons, Cuv. & Val., xix, 1846, 118 (Atlantic).

Habitat.—Atlantic Ocean, Newport, R. I.

The description of Cuv. & Val. is very imperfect, and their species has not been recognized by any subsequent author. It is said to be "distinguished by the prominence or convexity of that part of the head before the eyes"; "the muzzle is, besides, short, not concave, but rather convex on the superciliary region."

These characters well distinguish a species represented, in the museum of the Philadelphia Academy, by a specimen 8 inches long, collected at Newport, R. I., by Samuel Powell.

This species has not been noticed by any recent author, and for it we adopt, for the present, the name of *E. gibbifrons*. The following is a detailed description of this specimen:

Head 4 in length to end of last caudal vertebra; depth $5\frac{1}{5}$. D. 12, A. 9. Lateral line about 46; length of specimen 8 inches.

Body robust, little compressed. Head rather short, interorbital area slightly concave, about $\frac{1}{4}$ wider than eye; profile of snout convex, descending more abruptly than in any other of our species, making a decided curve downward. Snout rather blunt, 4 in head; eye 3 in head; maxillary $4\frac{1}{2}$ in head; pectoral fins rather broad and long, their length $1\frac{1}{2}$ in length of body; tips of pectorals reaching to tips of last rays of dorsal. First ray of pectoral simple, its length $2\frac{1}{5}$ in length of fin; second ray simple, about $\frac{1}{2}$ longer than first ray; third ray divided; fourth ray longest.

Origin of ventrals midway between posterior margin of eye and last caudal vertebra; length of ventrals 2.9 in length of body, their tips reaching to last ray of anal.

Origin of dorsal fin far in advance of the anal. Base of anal $1\frac{3}{5}$ in base of dorsal. Longest dorsal ray $2\frac{1}{5}$ in head, longest anal ray about

3 in head. Lower lobe of caudal about $3\frac{1}{2}$ in body; least depth of caudal peduncle $3\frac{1}{5}$ in head.

About 25 scales in lateral line before ventrals, and about 30 scales before dorsal; 7 scales between lateral line and dorsal fin.

Color, brown above, silvery below; on each scale on the upper part of the body is a darker brown spot near its posterior extremity. This gives the appearance of a dark-brown streak along each row of scales.

Pectorals uniformly colored, same color as upper part of body. Ventrals dusky, nearly black mesially, the posterior part of the fin still darker; no dark markings on dorsal or anal fins; caudal dusky, plain.

LIST OF NOMINAL SPECIES WITH IDENTIFICATIONS.

The following is a list of the nominal species referred to in the foregoing paper, arranged in chronological order, with our identification of each. Tenable specific names are printed in italics:

Nominal species.	Year.	Identification.
Exocœtus *volitans*, Linnæus	1758	Exocœtus volitans.
Exocœtus *evolans*, Linnæus	1766	Halocypselus evolans.
Exocœtus *exiliens*, Gmelin	1788	Exocœtus exiliens.
Exocœtus *mesogaster*, Bloch	1797	Parexocœtus mesogaster.
Exocœtus *heterurus*, Rafinesque	1810	Exocœtus heterurus.
Exocœtus comatus, Mitchill	1815	Exocœtus heterurus. (?)
Exocœtus *furcatus*, Mitchill	1815	Exocœtus furcatus.
Exocœtus noveboracensis, Mitchill	1817	Exocœtus heterurus.
Exocœtus splendens, Abel	1818	Halocypselus evolans.
Exocœtus nuttalli, Le Sueur	1821	Exocœtus furcatus.
Exocœtus fasciatus, Le Sueur	1821	Exocœtus exiliens.
Exocœtus appendiculatus, Wood	1824	Exocœtus heterurus. (?)
Exocœtus *nigricans*, Bennett	1840	Exocœtus nigricans.
Exocœtus *bahiensis*, Ranzani	1842	Exocœtus bahiensis.
Exocœtus lineatus, Cuv. & Val	1846	Exocœtus heterurus. (?)
Exocœtus speculiger, Cuv. & Val	1846	Exocœtus volitans.
Exocœtus *cyanopterus*, Cuv. & Val	1846	Exocœtus cyanopterus.
Exocœtus *rufipinnis*, Cuv. & Val	1846	Exocœtus rufipinnis.
Exocœtus melanurus, Cuv. & Val	1846	Exocœtus heterurus.
Exocœtus bicolor, Cuv. & Val	1846	Exocœtus nigricans.
Exocœtus *rondeletii*, Cuv. & Val	1846	Exocœtus rondeletii.
Exocœtus *gibbifrons*, Cuv. & Val	1846	Exocœtus gibbifrons.
Exocœtus spilopus, Cuv. & Val	1846	Exocœtus nigricans.
Exocœtus *acutus*, Cuv. & Val	1846	Fodiator acutus.
Exocœtus orbignianus, Cuv. & Val	1846	Parexocœtus mesogaster. (?)
Exocœtus georgianus, Cuv. & Val	1846	Halocypselus evolans. (?)
Exocœtus monocirrhus, Richardson	1846	Halocypselus evolans. (?)
Exocœtus roberti, Müller & Troschel	1846	Exocœtus volitans.
Exocœtus hillianus, Gosse	1851	Parexocœtus mesogaster.
Exocœtus quadriremis, Gronow	1854	Exocœtus volitans. (?)
Exocœtus (Cypselurus) procne, Filippi & Verany	1857	Exocœtus furcatus.
Exocœtus vermiculatus, Poey	1858	Exocœtus bahiensis.
Exocœtus chilensis, Abbott	1860	Halocypselus evolans.
Exocœtus spilonopterus, Bleeker	1863	Exocœtus bahiensis.
Exocœtus dowii, Gill	1863	Exocœtus rufipinnis.
Exocœtus albidactylus, Gill	1863	Exocœtus cyanopterus. (?)
Exocœtus *californicus*, Cooper	1864	Exocœtus californicus.
Exocœtus obtusirostris, Günther	1866	Halocypselus evolans.
Exocœtus affinis, Günther	1866	Exocœtus volitans.
Exocœtus *robustus*, Günther	1866	Exocœtus robustus.
Exocœtus brachycephalus, Günther	1866	Exocœtus rondeletii. (?)
Exocœtus *callopterus*, Günther	1866	Exocœtus callopterus.
Exocœtus lamellifer, Kner & Steindachner	1866	Exocœtus exiliens.
Exocœtus gryllus, Klunzinger	1870	Parexocœtus mesogaster.
Exocœtus scylla, Cope	1871	Exocœtus rufipinnis.
Exocœtus parræ, Poey	1875	Exocœtus bahiensis. (?)
Exocœtus maculipinnis, Vinciguerra	1883	Exocœtus furcatus.
Exocœtus volador, Jordan	1884	Exocœtus rondeletii.
Exocœtus *vinciguerræ*, Jordan & Meek	1885	Exocœtus vinciguerræ.

RECAPITULATION.

We here repeat the list of species recognized by us, with a brief statement of such doubts as may exist in regard to them. The distribution of each species is indicated by the letters U (Atlantic coast of United States, C (California), W (West Indies and Brazil), A (Western Africa), E (Europe), P (Pacific coast of Mexico and Central America), G (west coast of South America), X (East Indies).

GENUS 1.—FODIATOR, Jordan & Meek.

1. **Fodiator acutus**, Cuv. & Val. P. W. A.

GENUS 2.—PAREXOCŒTUS, Bleeker.

2. **Parexocœtus mesogaster**, Bloch. U. W. X.

GENUS 3.—HALOCYPSELUS, Weinland.

3. **Halocypselus evolans**, Linnæus. E. A. U. W. G. X.
(Possibly includes two or three species.)

GENUS 4.—EXOCŒTUS, (Artedi) Linnæus.

4. **Exocœtus exiliens**, Gmelin. W. U. S.
(Name to be adopted possibly doubtful.)

5. **Exocœtus rondeleti**, Cuv. & Val. E. U. W. A.
(Possibly the adult of *E. exiliens*.)

6 **Exocœtus vinciguerræ**, Jordan & Meek. E. U.

7. **Exocœtus volitans**, Linnæus. U. W. X. G. E.?

8. **Exocœtus rufipinnis**, Cuv. & Val. P. W.
(Possibly two species, *rufipinnis*, *scylla*, included under this name.)

9. **Exocœtus heterurus**, Rafinesque. U. W. E. A.
(Possibly the bearded *E. comatus* is a different species.)

10. **Exocœtus robustus**, Günther. W.? X.
(Doubtful identification.)

11. **Exocœtus furcatus**, Mitchill. U. W. E.

12. **Exocœtus cyanopterus**, Cuv. & Val. W.
(Unknown to us; possibly includes two species, *cyanopterus*, *albidactylus*.)

13. **Exocœtus nigricans**, Bennett. W. X. E.

14. **Exocœtus bahiensis**, Ranzani. W. X. E.

15. **Exocœtus californicus**, Cooper. C.

16. **Exocœtus callopterus** Günther. P.
(Possibly identical with some East Indian species of prior name.)

17. **Exocœtus gibbifrons**, Cuv. & Val. U.

INDIANA UNIVERSITY, *February* 24, 1884.

NOTES ON SKELETONS OF ETHEOSTOMATINÆ.

By DAVID S. JORDAN and CARL H. EIGENMAN.

The junior author of the present paper has prepared the skeletons of 20 species of *Etheostomatinæ.* These have been studied with a view to ascertaining what skeletal characters, if any, distinguish this group as a whole from the *Percinæ*, and also in what respects the different subordinate groups or genera are distinguished from each other.

The studies here made have been, in a measure, superficial, and refer especially to the upper parts of the cranium and the numbers of the vertebræ. A detailed comparison of the smaller bones, especially those of the lower parts of the head, offers numerous difficulties, as several of the species examined do not reach a greater length than two inches. The jaws and the membrane bones of the skull, being sufficiently described elsewhere, are not noticed in this paper.

1. **Percina caprodes**, Raf.

This species is the largest of the Darters, and in the structure of the cranium it is the one which approaches nearest to the typical Perches. In this respect, it is evident that *Percina* is more nearly allied to the other Darters than it is to *Perca.* Its cranium is decidedly more like that of *Perca* than like that of *Stizostedion.* So far as the cranium is concerned, *Perca* is probably nearer *Percina* than either is to *Stizostedion.*

Comparing the skull of *Percina* with that of *Perca*, we find that in the former the bones of the skull above are much smoother; the ridges and grooves on the frontal, parietal, and mastoid regions, conspicuous in *Perca*, are nearly obsolete in *Percina.* The tube-like pores on the frontal bones conspicuous in *Perca* are barely visible in *Percina.* Parietals and supraoccipital with radiating striæ, more regular than in *Perca*, the ridges lower and less sharp. Frontal region narrower than in *Perca*, and less depressed. Supraoccipital bone longer than in *Perca*, its crest very much smaller, not rising to level of the occiput. Sutures of skull more distinct than in *Perca.* Skull in profile less convex at occiput, more elevated between eyes.

Suprascapula in *Percina* trifurcate, the forks slender, the posterior part without serration; its form similar to that of *Perca.* Scapula, L-shaped, thinner and weaker than in *Perca*; its edge not serrate. Foramen of ulna much larger than in *Perca.* Pelvic bones proportionately shorter and broader than in *Perca.* Coracoid without serrations. Rest of skeleton essentially as in *Perca*; number of vertebræ, 23 + 21 = 44. Lower pharyngeals triangular-elliptical, with large teeth.

As compared with the other Darters, the skull of *Percina* is much broader between the eyes; the parietal bones are more strongly ridged, the sutures more distinct, the top of the cranium beyond the eyes more

depressed, and the supraoccipital crest more developed than in most of the others. In all these respects *Percina* is intermediate between *Perca* on the one hand, and the extreme forms, *Ammocrypta* and *Microperca*, on the other.

The other Darters form two irregular lines, the one with depressed cranium, and slenderer bones, culminating in *Ammocrypta*; the other having the cranium more convex transversely, the bones firmer and smooth, and the vertebræ fewer in number. This group seems to culminate in *Microperca*.

2. **Hadropterus aspro**, Cope & Jordan.

This species has the skull smoother than in *Percina*, its surface more convex transversely; frontal region very narrow, grooved; parietals slightly striate, somewhat depressed behind the eyes, but less than in *Boleosoma*. Supraoccipital large, its crest reduced to a minute process. Profile essentially as in *Percina*. Bones of shoulder-girdle and pharyngeals essentially as in *Percina*. Pyloric cœca, 4. Vertebræ, $19 + 23 = 42$.

3. **Hadropterus scierus**, Swain.

Skull essentially as in *H. aspro*. Vertebræ $18 + 22 = 40$.

4. **Hadropterus evides**, Jordan & Copeland.

Skull essentially as in *H. aspro*, the parietal region a trifle smoother and a little more convex transversely. Vertebræ $18 + 22 = 40$.

5. **Hadropterus phoxocephalus**, Nelson.

Skull more elongate than in *H. aspro*, the frontal region very narrow. Parietals smooth, somewhat depressed above, but rather strongly convex transversely; no supraoccipital crest. Suprascapula slender; scapula broad. Profile most prominent behind eye. Vertebræ $19 + 20 = 39$. Pyloric cœca 2. This species is chiefly peculiar in the narrowness of the head.

6. **Cottogaster copelandi**, Jordan.

Skull short, the frontal region rather short and not very narrow. Parietals faintly striate, depressed above, little convex transversely. Sutures distinct. Supraoccipital crest obsolete; scapula broad. Profile most prominent above eye. Pyloric cœca 3. Vertebræ $18 + 20 = 38$.

7. **Ulocentra simotera**, Cope.

Skull not very narrow anteriorly. Parietal region rather depressed, not strongly transversely convex, its bones faintly grooved. Frontal region much broader than in *Diplesion blennioides*, the top of the head much flatter. Profile highest above posterior margin of eye, scapula rather broad. Supraoccipital crest small. Vertebræ $15 + 23 = 38$.

So far as the skull is concerned, this species more resembles *Cottogaster* than *Diplesion*.

8. Diplesion blennioides, Rafinesque.

Frontal region very narrow. Ethmoid region abruptly decurved. Parietal region rather convex transversely, rather broad, the bones finely striate, with obscure sutures. No supraoccipital crest. Suprascapula very short. Scapula rather broad, L-shaped. Profile low posteriorly, full above eyes. Skull more flattened above than in *Etheostoma*, but less so than in *Cottogaster*, *Hadropterus*, &c. Pyloric cœca 4. Vertebræ 19 + 23 = 42.

This species approaches more closely to *Etheostoma* than do any of the preceding, so far as the form of the cranium is concerned. The group of which *Etheostoma zonale* is the type apparently marks the transition from the one series to the other.

9. Boleosoma maculatum, Agassiz.

Frontal region short, very narrow. Parietal region flattish above, its bones faintly striate. No supraoccipital crest. Profile most convex above front of eye. Suprascapular processes slender. Pyloric cœca 6. Vertebræ 15 + 22 = 37.

10. Boleosoma camurum, Forbes.

Skull essentially as in *B. maculatum*. Pyloric cœca 3. Vertebræ 17 + 21 = 38.

11. Ammocrypta pellucida, Baird.

Frontal region narrow. Parietal region depressed, flattish; the bones thin, nearly smooth. Sutures very distinct. Supraoccipital crest obsolete. Profile highest above posterior part of eye. Ulnar foramen very large. Scapula and suprascapula slender; all the bones of the body comparatively slender and thin. Top of head rather more flattened than in any other genus. Pyloric cœca 4. Vertebræ 23 + 21 = 44.

12. Ammocrypta vivax, Hay.

Skeleton essentially as in *A. pellucida*, the sutures of the skull perhaps less distinct. Vertebræ 21 + 20 = 41. Pyloric cœca 4.

The remaining species, now referred to *Etheostoma* and *Microperca*, agree very closely with one another in the form of the cranium, which is narrow behind the eyes, across the parietal region, and very strongly convex transversely. In these species the vertebræ are more or less reduced in number and there are usually fewer rays in the spinous dorsal and anal.

13. Etheostoma zonale, Cope.

Frontal region very short, moderately narrow. Parietal region very strongly convex transversely, the bones with radiating striæ. No supraoccipital crest. Profile most prominent above posterior part of eye. Pyloric cœca 4. Vertebræ 16 + 23 = 39.

This species differs from the others referred to *Etheostoma* chiefly in the shortness and decurvature of the frontal region.

14. Etheostoma variatum, Kirtland.

Skull narrow, the parietal region strongly convex transversely, supraoccipital and parietals with fine radiating striæ. Supraoccipital large, its crest obsolete. Sutures obscure. Scapula shorter and broader than in *Percina;* shoulder girdle otherwise similar. Profile much as in *Percina*, highest at occiput. Lower pharyngeals narrowly triangular. Pyloric cœca 3. Vertebræ 15 + 21 = 36.

15. Etheostoma lepidum, Baird & Girard.

Skull essentially as in *E. variatum*, the sutures more distinct. Pyloric cœca 2. Vertebræ 16 + 19 = 37.

16. Etheostoma maculatum, Kirtland.

Frontal region narrow. Parietal region narrow, very convex transversely. Profile highest at occiput, essentially as in *E. variatum*, the skull a little narrower. Pyloric cœca 4. Vertebræ 15 + 24 = 39.

17. Etheostoma whipplei, Girard.

Skull essentially as in *E. variatum*, the profile lower above the eyes. Pyloric cœca 3. Vertebræ 15 + 21 = 36.

18. Etheostoma flabellare, Rafinesque.

Frontal region longer and narrower than in any other species. Parietal region very strongly convex transversely, surface of skull smooth; a trace of supraoccipital crest. Profile low, highest at occiput. Differs from *Etheostoma variatum* chiefly in the greater length and compression of the head. Pyloric cœca 3. Vertebræ 13 + 20 = 33. Lower pharyngeals very narrow.

19. Etheostoma fusiforme, Girard.

Skull essentially as in *E. variatum*. Pyloric cœca 3. Vertebræ 16 + 20 = 36.

20. Microperca punctulata, Putnam.

Frontal region not very narrow. Parietal region transversely convex, its bones smooth. No supraoccipital crest; sutures very distinct; skull highest above posterior part of eye. Vertebræ 14 + 16 = 30.

So far as the skeletons are concerned, we seem to be justified in the following inferences:

1. The *Etheostomatinæ* are near allies of the *Percinæ*, and should not form a separate family.

2. They are among themselves closely related, and the extreme forms are so connected by intermediate forms that they might with no great violence to nature be regarded as forming a single genus.

3. The species nearest allied to the typical *Percinæ* is *Percina caprodes*. This is the largest in size, and of the others in general those smallest in size are most aberrant in structure.

4. Those species which have usually been grouped together on external charaters agree in general in regard to the skeleton.

5. As most of the skeletal characters change by degrees, none of them are of much use in defining genera.

6. Those skeletal characters apparently of most importance are in the structure of the mouth, the breadth of the frontal region (*Percina*), the number of vertebræ, and the outline of a transverse section of the skull across the parietals, whether , as in *Boleosoma*, &c., or , as in *Etheostoma*. The prolongation of the frontals in *Etheostoma flabellare* and in *Hadropterus phoxocephalus* and its shortness in *Etheostoma zonale* seem to be purely specific characters. The development of the nearly obsolete supraoccipital crest, the distinctness of the sutures, and the sculpture of the parietals are features which offer no basis for trenchant division, except, perhaps, as distinguishing *Percina* from all the others.

6. As defined by skeletal characters alone, we may distinguish *Percina*, *Etheostoma*, *Microperca*, and perhaps *Diplesion* and *Ammocrypta* from the rest as distinct genera. The other groups, if retained, must be separated from these and from each other by other characters.

INDIANA UNIVERSITY, *March* 3, 1885.

NOTE ON THE SCIENTIFIC NAME OF THE YELLOW PERCH, THE STRIPED BASS, AND OTHER NORTH AMERICAN FISHES.

By DAVID S. JORDAN.

By the rules of nomenclature now adopted by the American Ornithologists' Union (rules which the present writer proposes to follow in future ichthyological papers), certain names now in current use in North American Ichthyology become untenable. The following cases come under the rule, which has been thus formulated, "Once a synonym, always a synonym."

1. The name *Perca americana* (Schranck 1794) is antedated by *Perca americana* Gmelin (= *Roccus* (*Morone*) *americanus*). The yellow Perch must therefore stand apparently as *Perca lutea*. The name *Centropomus luteus*, Rafinesque, "Précis des Découvertes Somiologiques, 1814," is apparently prior to that of *Bodianus flavescens*, Mitchill, 1815.

2. The name *Perca saxatilis*, Bloch & Schneider is similarly antedated by *Perca saxatilis* of Bloch, which is a species of *Crenicichla*. The name next in date is that of *Perca septentrionalis*, Bloch & Schneider, Syst. Ichth., 90. The Striped Bass may therefore stand as *Roccus septentrionalis*.

3. Similarly the species described by Girard as *Gobius gracilis* is different from the earlier *Gobius gracilis* of Jenyns. The former should stand as *Lepiogobius lepidus*, from the later name of *Gobius lepidus*, Grd.

4. *Lepadogaster reticulatus*, Girard is preoccupied by *Lepadogaster re-*

ticulatus, Risso. The later name, *Gobiesox mæandricus*, (Girard) should therefore be used instead of *Gobiesox reticulatus*.

5. *Cyprinus americanus*, Linnæus, in the Tenth Edition of the Systema Naturæ is a *Menticirrus*, while the species of the same name in the Twelfth Edition is a *Notemigonus*. The name *Notemigonus americanus*, based on the latter, should thus give way to *Notemigonus bosci*, (Cuv. & Val.), or better *Notemigonus chrysoleucus bosci*.

6. *Catostomus carpio*, Rafinesque, an *Ictiobus*, has priority over *C. carpio*, Cuv. & Val., a *Moxostoma*. The latter species having no synonyms, may receive the new name of *Moxostoma valenciennesi* instead of *Moxostoma carpio*.

INDIANA UNIVERSITY, *March* 4, 1885.

DESCRIPTION OF A NEW SPECIES OF PLECTROMUS (P. CRASSICEPS) TAKEN BY THE UNITED STATES FISH COMMISSION.

By TARLETON H. BEAN,
Curator of the Department of Fishes.

Of this new species a single example, number 33553, was obtained in the greatest depth explored by the Albatross (2,949 fathoms); it is only 48 millimeters long, and in very bad condition. Fortunately the same vessel took three larger and better preserved individuals of the same species, which are numbered 33378, 33509, and 34835, respectively; these are from stations 2075, 2094, and 2106, the depths being 855, 1,022, and 1,497 fathoms. The large examples are made the basis of the description which follows:

PLECTROMUS CRASSICEPS, n. s.

33378. 1 specimen; latitude 41° 40′ 30″ N.; longitude 65° 35′ W.; September 3, 1883.
33509. 1 specimen; latitude 39° 44′ 30″ N.; longitude 71° 04′ W.; September 21, 1883.
34835. 1 specimen; latitude 37° 41′ 20″ N.; longitude 73° 03′ 20″ W.: Nov. 6, 1883.

The species resembles *Melamphaës megalops*, Lütken, from which it differs in having a much smaller eye, larger scales, and shorter ventrals. (Dr. Lütken's species, which he referred only after much hesitation to *Melamphaës*, is, in all probability, congeneric with *Plectromus suborbitalis*, Gill.) The length of the head equals $\frac{1}{3}$, and the height of the body $\frac{2}{7}$ of the total length without caudal. The eye is about $\frac{2}{9}$ as long as the head. The maxilla extends to, or slightly beyond, the vertical through the hind margin of the eye. The pectoral is as long as the head and more than twice as long as the ventral, which does not quite reach to the vent. The scales are large and mostly wanting in the typical examples; there are about 25 rows in a longitudinal series. D. ii, 11–12; A. i, 8–9; V. 8; P. 15.

The specimens are uniformly dark (nearly black) in spirits, except on the fins, which are somewhat lighter at the margins.

The genus *Plectromus*, Gill (Proc. U. S. Nat. Mus., VI, 257) is not sufficiently distinguished, in the description, from *Melamphaës*, Günther; but its smaller number of spines may prove constant and will enable us to separate the two with certainty. The dentition also, concerning which there is some doubt, may be different in *Melamphaës*.

DESCRIPTION OF A NEW SPECIES OF ASPIDOPHOROIDES (A. GÜNTHERII), FROM ALASKA.

By **TARLETON H. BEAN,**

Curator of the Department of Fishes.

Capt. M. A. Healy's collection, made during the cruise of the United States revenue cutter Thomas Corwin, 1884, contains four specimens of this new species, the largest of which is 53 millimeters ($2\frac{1}{10}$ inches) in length. Lieut. G. M. Stoney also obtained a specimen, and as his is larger than any of the others I will make it the type of the description.

The type of the species here described is an example 70 millimeters long (Cat. No. 37032).

This fish does not bear much resemblance to *monopterygius* and *inermis*. The body is very short and is anteriorly very wide and somewhat depressed. The head also is short, triangular, and posteriorly wide. There is also a short barbel at the end of each maxilla. The nasal spines are almost invisible. There are small teeth in the jaws, vomer, and palatines. Along the sides of the head inferiorly are four large mucous pores, each situated in an oblong depression, the largest of which is nearly as long as the snout. The maxillary barbel is scarcely one-half as long as the eye, which is one-third the length of the head and considerably more than the width of the interorbital space. The maxilla does not extend much beyond the anterior margin of the orbit. The mandible is barely included; its length equals that of the eye. The length of the snout equals the width of the interorbital space, which is deeply concave. The greatest depth of the head is not much more than one-half its greatest width. The greatest width of the head over the opercles is contained nearly five times in the total length without caudal, and twice in the distance from the origin of the dorsal to the base of the caudal. The gill-membrane is narrowly attached to the isthmus anteriorly, but the posterior margin is free and the gill-opening is wide. Pseudobranchiæ well developed. There is a deep groove extending from the occiput and including about the anterior third of the body. The greatest height of the body is one-sixth of the length without caudal, and the width over the basis of the pectorals is about one-fifth of the same length. The length of the head is contained about $4\frac{1}{3}$ times in the total length without caudal. The pectoral is $2\frac{1}{2}$ times as long as the ventral and one-fourth of the total length without caudal. The ventral is as

long as the head without the postorbital part. The vent is between the ventrals, but nearer their tips than their origin. The origin of the dorsal is nearly midway of the total, including caudal. The length of the dorsal base is contained about $6\frac{2}{3}$ times in total length without caudal. The anal is immediately under the dorsal, but its base is not quite so long. The length of the caudal is contained about $5\frac{1}{2}$ or 6 times in the standard body length. Second dorsal ray is longest, its length about equal to the postorbital part of the head. The longest anal ray is less than one-fourth the length of the head. Lateral line 40. The breast is armed with about 14 plates.

A dark stripe on the snout, and continued behind the eye on the opercle; a few indistinct dark blotches on the side of the head; axillary region dusky. Pectoral with 3 or 4 imperfect cross-bars. Body with 3 indistinct saddle-shaped dusky half bars, the middle one of which extends up on the middle of the dorsal fin. These bars do not extend below the median line of the body. Tail with 2 dusky bars, one anteriorly and the other terminal, the two separated by a dirty yellowish area. General color dusky above, whitish below; this color also present on ventral and anal.

D. 7; A. 7; V. I, 2; C. 10; P. 12.

The ventral of *Aspidophoroides monopterygius* consists also of a short spine and 2 rays. The union of the gill-membrane to the isthmus in *monopterygius* is the same as in *güntherii*. There are vomerine and palatine teeth in *monopterygius*, contrary to the statements of most ichthyologists. The obsolete nasal spines, the maxillary barbels, and the form of the body offer the only characters by which this species might be distinguished from the *monopterygius* type, and we have the *inermis* as a connecting link between *monopterygius* and *güntherii*.

I have named the species for Dr. Albert Günther, of the British Museum, to whose writings and personal kindness I am deeply indebted.

U. S. NATIONAL MUSEUM,
Washington, March 11, 1885.

REMARKS ON THE TYPE SPECIMEN OF BUTEO OXYPTERUS, CASSIN.

By ROBERT RIDGWAY.

In "History of North American Birds," vol. iii, pp. 266–268, this bird was referred to *Buteo swainsoni*, Bp., although recognized as representing a local or geographical race under the title of "*Buteo swainsoni*, var. *oxypterus*." The type specimen is there described, and also in a paper published in the "Proceedings" of the Philadelphia Academy of Natural Sciences for 1875 (pp. 113, 114), where, however, the "var. *oxypterus*" is not recognized. The type specimen is again specially referred to in Mr. J. H. Gurney's "List of the Diurnal Birds of Prey,"

p. 68, where the following remarks, written by me to Mr. Gurney, are quoted:

"It has been more than ten years since I saw the specimen in question; but my recollection of it is that it agreed very exactly with a specimen from Costa Rica and another from Buenos Ayres, both of which are in the National Museum collection, and both of which are unquestionably young of typical *B. swainsoni.*"

Having recently been enabled, through the courtesy of the authorities of the Philadelphia Academy, to make an actual comparison of the three specimens involved in the above statement, and having found the same to be incorrect, I wish to offer some remarks which may throw more light on *B. oxypterus* and its relationships.

Although smaller than any example in the National Museum collection, "*B. oxypterus*" is unquestionably referable to *B. swainsoni.* It is a young bird, and probably a male. Dr. Bryant's statement (Pr. Boston Soc. viii, 1861, p. 118) to the following effect is incorrect: "Several of the primaries in both wings of this bird are only partially developed, which gives the wing a peculiarly sharp appearance." On the contrary, the primaries are all full grown, their proportionate length, compared with one another and with the secondaries, and all other details of wing-structure, being exactly as in other specimens of *B. swainsoni.* Mr. Cassin, in his original description, did not compare "*B. oxypterus*," with *B. swainsoni* at all, but with *B. pennsylvanicus*, a species very different in respect to its wing-formula, and in comparison with which *B. swainsoni* may very appropriately be termed "sharp-winged."

In coloration, the type of "*B. oxypterus*" does not resemble the Costa Rica and Buenos Aires specimens so much as I had supposed. The latter are much variegated with pale ochraceous on the upper parts, while the former is nearly uniform above, the wings quite so. The nearest approach among National Museum examples is No. 67248, a young male from Camp Grant, Arizona (September 28, 1873, H. W. Henshaw), which is much like it in the markings of the lower parts, though the thighs are much less regularly barred; but the wing coverts are broadly bordered with buff. It is likewise larger, the wing measuring 14.75 inches.

Upon the whole, I cannot see the slightest reason for recognizing "*B. oxypterus*" even as a local race of *swainsoni*, the type being exceptional as to size, while the *average* difference in dimensions between northern and southern specimens is insignificant.

The specimen described in "History of North American Birds" (iii, p. 266), as the melanistic adult of "*Buteo swainsoni* var. *oxypterus*" is not *B. swainsoni* at all, but *B. fuliginosus*, Scl., which is said (and probably with truth) to be the melanistic phase of *B. brachyurus*, Vieill. This I have been able to determine beyond question by an examination of the wing formula, which is radically distinct in the two species, al-

though *B. brachyurus*, like *B. swainsoni*, has only three primaries emarginated. The two differ as follows:

B. swainsoni.—Wing more than 13.50 inches; difference between tips of longest primaries and those of longest secondaries (tertials) much more than one-third the length of the wing. Third and fourth quills longest; second longer than fifth; first much longer than eighth (sometimes equal to seventh). Second, third, and fourth quills with outer webs sinuated; inner web of fourth quill never with indication of sinuation.

B. brachyurus.—Wing less than 13.50 inches; difference between tips of longest primaries and those of longest secondaries less than one-third the length of the wing. Third, fourth, and fifth quills longest; second shorter than fifth, usually about equal to sixth (rarely a little shorter); first shorter than eighth (usually a little shorter than ninth). Second, third, fourth, and fifth quills with outer webs sinuated; inner web of fourth quill usually more or less sinuated.

EARLY IRON MANUFACTURE IN VIRGINIA—1619–1776.

By **R. A. BROCK.**

Secretary of the Virginia Historical Society.

[Accompanying specimens of slag from the old foundry at Falling Creek, Va., established in 1619. Donation No. 9378.]

To Virginia, the first of the English settlements in America, belongs the honor of inaugurating within her limits as a colony that most important industry, iron manufacture.

The London Company, it is exhibited, contemplated a variety of manufacturing enterprises from the very beginning of its authority; prominent among them was that of iron.

In 1610, Sir Thomas Gates testified before the council of the company at London that in Virginia "there were divers minerals, especially 'iron oare,'" lying upon the surface of the ground, some of which having been sent home had been found to yield as good iron as any in Europe.*

Under a new administration of its affairs, the London Company, in 1619, after twelve years of unprofitable expenditure, sent to Virginia a large body of emigrants, including workmen, and materials for some new branches of industry. These embraced no less than one hundred persons skilled in the manufacture of iron, with the design of erecting in the colony three iron works. Of these, one hundred and ten were from Warwickshire and Staffordshire and forty from Sussex, and were selected for their skill and industry.†

* True Declaration of Virginia, 1610; Force's Tracts, Vol. III, p. 22.

† A Declaration of the state of the Colonies, &c., 1620, p. 10; Stith's History of Virginia, Book IV, p. 176.

A part of the funds liberally contributed in England about the same time for a college at Henrico, for the education of native and colonial youth, was appropriated by the treasurer, Sir Edwin Sandys, to the erection of iron works, in the expectation of deriving a revenue from that source. Works for smelting the ore were erected in 1619 on Falling Creek, a tributary of James River, in Chesterfield County, about seven miles below the city of Manchester. Most sanguine hopes of profit from this undertaking were cherished.

Three of the master workmen having died, a re-enforcement of twenty experienced hands was sent over in 1621, accompanied by Mr. John Berkeley and his son Maurice, as skillful persons to superintend the operations. A mine of the brown iron ore in the neighborhood was opened and found to yield "reasonably good iron."* But the jealousy and enmity of the native inhabitants had unfortunately been aroused. In an hour of fancied security, when all suspicions of hostility had been lulled by the friendly protestations of the Indians, on the morning of Friday, March 22, 1622, a general attack was made by the savages upon the settlements in the colony, and 347 persons slain. Of those engaged at the iron works at Falling Creek all perished save a boy and girl, who fled to the bushes for safety.†

The iron works being demolished, so great was the discouragement consequent that a long period elapsed before the useful manufacture was again attempted in Virginia. A writer from the colony in 1649 published that "an iron work erected would be as good as a silver mine."‡

The exportation of iron from the colony was forbidden by an act of the assembly in 1662, on penalty of ten pounds of tobacco for every pound of iron exported, and the prohibition was renewed in 1682.

Col. William Byrd, the first of the name and family in Virginia, obtained, April 20, 1687, a grant of 1,800 acres in Henrico County, on the south side of James River, within the limits of which was included the site of the fated iron-works on Falling Creek. On the 29th of October, 1696, he obtained a patent for 5,644 acres lying contiguous thereto, giving as a reason for such action, in a note prefixed to his record of his landed possessions, that "there having been iron-works on Falling Creek in the time of the company, and Colonel Byrd having an intention to carry them on, and foreseeing that abundance of wood might be necessary for so great a work, he took up a large tract," &c., as above. He died on the 4th day of December, 1704, and it is not known that either he or his son and heir, of the same name and title, ever instituted any further steps towards the revival of the works at Falling Creek, as apparently projected.§

* Beverley's History of Virginia.

† Stith, Book IV, p. 218; Bishop's American Manufactures, I, pp. 468–469.

‡ A Perfect Description of Virginia, London, 1649, Force, vol. ii, No. 8.

§ MS. Deed-Book of William Byrd.

Governor Alexander Spottswood appears to have been the first to break the spell of dormancy in the iron industry in Virginia, which he did by the establishment of a smelting furnace on the Rappahannock River near the present site of Fredericksburg, and of a very complete air-furnace at Massaponax, fifteen miles distant, on the same river, and near the site of his settlement, Germanna.

In an account-book (1726-'30) kept by Rev. Robert Rose, who was an agent for Governor Spottswood, there are numerous entries of fire-backs cast at Germanna which were sold by him. In 1732 there were four furnaces operated on the Rappahannock, in one of which, Principio furnace, Augustine, the father of George Washington, was largely interested; the ore used in it being supplied by him from his plantation at Bridge's Creek, on the east side of the river.*

The Falling Creek tract fell to the possession of Col. Archibald Cary some time prior to the Revolutionary war. Upon it he erected his well-known seat, the name of which became in the records of the period a part and parcel of his personal designation as Archibald Cary, of Ampthill. He erected new iron-works on Falling Creek. "He purchased pigs of iron from Rappahannock, Patowmack, and Maryland. Of these he made bar iron. The profits, however, were so small that he abandoned his forge and converted his pond to the use of a grist-mill about 1760. Nobody then knew of any iron mine convenient to Falling Creek."†

The writer visited Ampthill and Falling Creek in May, 1876. The mansion was then in fair preservation. It is now owned by Mr. John Watkins, of New York.

Falling Creek is about a mile below Ampthill. Its waters still furnish motive power to a grist-mill owned by Mr. H. Carrington Watkins, and known as the Ampthill mill. The creek is but an insignificant rivulet above the mill, but some twenty yards below it widens into a handsome little lake, and some quarter of a mile thence empties into James River.

About sixty yards from the mill, on the western bank of the creek and nearing the river, the writer picked up several small pieces of furnace-cinder, presumptive relics of the iron-works of 1622. The bluff adjacent and incumbent has, it is evident from repeated washings of the soil, nearly covered the exact original site.

On the opposite side of the creek, and to the east of the mill, is clearly indicated the site of the forge of Archibald Cary. Here we found numerous pieces of slag or cinder, some of them fully a hundred pounds in weight, and an irregular area an acre or more in extent, covered

* Iron-making and Coal-mining in Pennsylvania, by Col. James M. Swank, p. 11.

† A marginal note in MS. on a copy of Stith's History of Virginia, Williamsburg, 1747, p. 218, which formerly belonged to Robert Bolling, of Chillowe, author of the Bolling Memoirs.

with finely-broken or comminuted charcoal to the depth of two feet fully; a memorial of the fuel used.

We were informed that about half a mile below Falling Creek, near James River, there is a low piece of ground known to this day as Iron Bottom, where may be found plentifully what is known as bog iron on the surface. It will be recollected that the iron ore already cited as being mentioned by Sir Thomas Gates was described as "lying on the surface of the ground." We have also learned since our visit to Falling Creek that at a point upon its banks distant inward about two miles from the site of the iron-works there are numerous pits some five or six feet in depth, which it is evident from the mineral character of their surroundings furnished the crude ore for the original and ill-starred works.

In June, 1870, a freshet, the result of previous heavy rains, overflowed and broke the dam at a point known as Old Forge, on the Jones branch of the Chickahominy River, in New Kent County, Virginia. Trees were overturned, a building undermined, and a gorge cut, uncovering in its route the remains of an early forge or smelting furnace. The foundation, portions of a chimney, an anvil, a hammer, and six bars of iron were exposed to view—one of the last bearing in raised letters the inscription "B. G., 1741," which were supposed to indicate the place and date of manufacture; the first of which was assumed to have been Bear Garden furnace, Buckingham County, Virginia. The forge is marked on Fry and Jefferson's Map of Virginia, 1765, as Holt's Forge. It must have commenced operations at a period not much later than 1741, if not as early, and was continued until some time during the Revolutionary war.

Tradition assigns to Col. William Byrd (the second) the credit of erecting and first working the forge, and Mr. William H. Christian, of Richmond, states that in his boyhood he was informed by an old negro man, named Guthridge, that his owner, one Jones, who operated the forge until its destruction, stationed him, then a youth, upon an eminence to watch the movements of the British soldiery who were in the section. Their approach being descried, the buildings were hastily fired and earth thrown upon the ruins to conceal the tools, &c. After the war bar iron was produced so cheaply in other sections that no efforts were made to revive the works. A grist-mill being erected in late years near the site of the forge, and driven by water from the pond used for its operations, was first called Providence Mills, but such was the force of custom that the residents of the section would retain the old designation, Forge; hence the new and old name has by common consent and usage been united in the component term Providence Forge.

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NOTE ON MR. GARMAN'S PAPER ON "THE AMERICAN SALMON AND TROUT."

By DAVID S. JORDAN.

In the "Nineteenth Annual Report of the Commissioners on Inland Fisheries of Massachusetts" is a paper on "the American Salmon and Trout, including introduced species," by Mr. Samuel Garman, of the Museum of Comparative Zoölogy. This paper gives a series of brief but excellent and pertinent descriptions of the various species of Salmon and Trout, as also a series of very useful outline figures representing the specimens examined. In general, Mr. Garman's determinations and names agree very closely with those given by Jordan & Gilbert in the "Synopsis of Fishes of North America," and it is very gratifying to us to find our conclusions verified by so careful an observer as Mr. Garman.

There are, however, a few points of difference between his results and ours. These I wish to notice in the present paper.

1. *Genera adopted.*—Mr. Garman refers all the Salmon and Trout to one genus, *Salmo.* I prefer to recognize *Oncorhynchus*, and especially *Salvelinus*, as distinct groups. This is, however, solely a matter of convenience.

2. *Nomenclature of varieties.*—Mr. Garman places under separate headings, under binomial names, forms which are certainly not species, and which at the most are geographical variations of trifling value and scarcely distinguishable. Thus he writes "*Salmo virginalis*," and says below, "a variety of *S. clarkii.*" If the *virginalis* be named at all, I prefer *Salmo clarkii* subsp. *virginalis*, or var. *virginalis*, or, still better, in accordance with current American usage, *Salmo clarkii virginalis.* To place such forms in co-ordinate paragraphs with the unquestionable species is productive of confusion. This again, however, is a matter of taste or convenience.

3. *Salmo* (*Oncorhynchus*) *hisutch.*—The name "*hisutch*," given by Walbaum, is a simple misprint for "*kisutch*," and the error is corrected by him in the "Emendanda," page 720. I do not think that the law of priority should require the retention of obvious misprints in spelling. The fish is still, as in the time of Steller, called *Kisutch* (Kee-zich) in Alaska.

4. *Salmo irideus* is regarded by Dr. Bean and myself as the inland form of the "Steelhead," *Salmo gairdneri.* This view, however, needs verification.

5. *Salmo clarkii.*—I see no reason for doubting the identity of this species with the one described from Kamtschatka by Pallas, under the

name of *Salmo purpuratus.* I have not Pallas's description at hand, but unless I am mistaken he refers to the crimson blotches under the lower jaw, which are characteristic of *Salmo clarkii* in all its forms and varieties. That *S. clarki* occurs in Kamtschatka admits of little doubt, as, according to Dr. Bean (Proc. U. S. Nat. Mus., 1881, 258), it is abundant all along the coast as far as Northern Alaska. As the species freely enters the sea northward, there is no *a priori* reason for supposing that it does not cross to Kamtschatka. This is perhaps the *Salmo mykiss* of Walbaum, a name still older than *S. purpuratus.*

6. *Salmo virginalis.*—Mr. Garman is probably right in regarding *Salmo spilurus* (with *S. pleuriticus*) as a variety of *S. clarki* rather than as a distinct species, as given in our Synopsis; but I think that he is wrong in regarding the *Salmo virginalis* of Utah Lake as the same form. I have examined the original types of *Salmo virginalis*, and I have collected many specimens of it in Utah Lake. I cannot distinguish this Utah fish from the *S. purpuratus* or *clarki* of the Columbia River. If I could separate it I should call it *Salmo purpuratus virginalis.*

7. *Salmo lewisi.*—Mr. Garman recognizes the Missouri River Trout as another variety of *Salmo clarki.* I have examined the original types of *S. lewisi*, as well as numerous other examples from the Upper Missouri and Yellowstone. When I had only seen a few specimens I thought that I could distinguish the trout of the Missouri from the trout of the Columbia. I cannot do it now. Mr. Garman is certainly wrong in referring the little land-locked trout of Waha Lake to the synonymy of *Salmo lewisi.* It is a color-variety only (a case parallel with that of *Salmo agassizi*), and its coloration is not that of the type of *Salmo lewisi.*

The forms of *Salmo purpuratus* may be arranged as follows:

Salmo purpuratus, Kamtschatka.
Salmo purp. clarki, California to Alaska.
lewisi, Missouri River.
bouvieri, Waha Lake, Idaho.
henshawi, Truckee River Basin.
virginalis, Utah Basin.
spilurus, Rio Grande and Colorado Basin.

Of these I would adopt *clarki*, *lewisi*, and *virginalis*, out of deference to Mr. Garman's opinion, but I do not know how to characterize them, nor do I think that I could pick them out if mixed up in an alcohol tank or in the bottom of a boat.

8. *Salmo naresi.*—No specimens of this species have yet been compared with *S. oquassa*, but the figure and description of *S. naresi* fits the latter very perfectly.

9. *Salmo agassizi.*—The trout of Dublin Pond has been known to me for many years. It is obviously a local color-variation of *S. fontinalis.* It may be called, in the current nomenclature, *Salvelinus fontinalis agassizi.*

10. *Salmo hoodi.*—As already noticed by Dr. Günther, part of the specimens called *Salmo hoodi* by Dr. Richardson belong to *S. fontinalis.* The other, a stuffed skin, I have examined in Dr. Günther's presence, and both of us were convinced that it was an ordinary *S. namaycush.* The name *hoodi* should therefore be dropped.

All the above-mentioned discrepancies between Mr. Garman's results and those reached by Dr. Bean, Professor Gilbert, and myself are more in name than in fact. No group in our vertebrate fauna offers such difficulties as the *Salmonidæ*, and it is rather remarkable that with so many different points of view such substantial agreement should exist.

INDIANA UNIVERSITY, *March* 17, 1885.

REPORT UPON THE ECHINI COLLECTED BY THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS, IN THE CARIBBEAN SEA AND GULF OF MEXICO, JANUARY TO MAY, 1884.

By **RICHARD RATHBUN.**

From January to May, 1884, while temporarily in the service of the Hydrographic Bureau of the Navy Department, the Fish Commission steamer Albatross, Lieut. Commander Z. L. Tanner, U. S. N., in command, made about fifty dredgings in the Caribbean Sea, and in the Gulf of Mexico off the northern side of the island of Cuba, the greatest depth reached in dredging having been 1,701 fathoms. Quite a rich collection of deep water animals was obtained, considering the small amount of time allotted to the natural history work, and at each of the ports visited the naturalists availed themselves of every opportunity to procure as complete a representation as possible of the littoral species. A list of the Echini obtained, accompanied with a few brief notes, is given below.

The shore stations at which Echini were collected, are as follows: Key West, Fla.; the island of St. Thomas; Jamaica; the island of Old Providence, off the coast of Nicaragua; the island of Curaçao, off the coast of Venezuela; the port of Sabanilla, United States of Colombia; and San Antonio, at the west end of Cuba. Only 25 species in all were obtained, and of these two are Spatangoids in very fragmentary condition, and still unidentified. Of the remainder, 9 are littoral species, although a single specimen of *Diadema setosum* was dredged at a depth of 215 fathoms, and 14 were from depths between 25 and 1,639 fathoms.

The identifications have been made by means of the recent publications of Mr. Alexander Agassiz, and a nearly complete series of the Echini supplied to the National Museum by Mr. Agassiz from the collections obtained by the Coast Survey steamer Blake in the region under discussion, from 1877 to 1880. There are but few facts to add to those already published by Mr. Agassiz in his very elaborate reports, and the notes have therefore been made very brief. Many of

the most interesting forms collected by the Blake in deep water were not obtained by the Albatross, but, as the latter steamer is now (1885) continuing her explorations in the Gulf of Mexico, it is possible that she will soon add largely to her former results.

It is but just to add that the fine condition of the many specimens brought in by the Albatross from this cruise is mainly due to the care bestowed upon them by Mr. James E. Benedict, the naturalist in charge, and Mr. Willard Nye, jr., who accompanied the steamer as a volunteer. The shore collections were almost entirely made by these two naturalists.

In the following notes the numbers inclosed in parentheses denote the catalogue numbers of the United States National Museum under which the specimens are registered.

Cidaris tribuloides, Blainv.

A large series of specimens of this species was obtained at Sabanilla (8391, 8612), and several specimens were taken at the island of St. Thomas (8390). Two young specimens were dredged at station 2138, latitude 17° 44′ 05″ N., longitude 75° 39′ W., 23 fathoms (7479); and two of the same character at station 2146, latitude 9° 32′ N., longitude 79° 54′ 30″ W., 34 fathoms (7489).

Dorocidaris Blakei, A. Agassiz.

Bull. Mus. Comp. Zool., vol. v, p. 185, pl. iv, 1878; Mem. Mus. Comp. Zool., vol. x, No. 1, p. 10, pl. i, ii, 1883.

Numerous specimens of the genus *Dorocidaris* were collected by the Albatross, but the majority were of small size and difficult of identification without the means of comparison with a more complete series of types than the Museum possesses. Only two species were recognized among them—*D. Blakei* and *D. papillata*. The former was positively determined from the three following stations:—

Station 2128; latitude 19° 55′ 46″ N., longitude 75° 49′ 23″ W., 400 fathoms; one characteristic fan-shaped spine (7487).

Station 2134; latitude 19° 56′ 06″ N., longitude 75° 47′ 32″ W., 254 fathoms; one large specimen (7483).

Station 2162; latitude 23° 10′ 30″ N., longitude 82° 20′ 25″ W., 122 fathoms; one medium specimen (7486).

Smaller specimens from the two following stations apparently belong to the same species:—

Station 2152; 2½ miles northwest of Havana Light, Cuba, 387 fathoms (7484).

Station 2153; latitude 23° 10′ 19″ N., longitude 82° 23′ 10″ W., 283 fathoms (7481).

Dorocidaris papillata, A. Agassiz.

All of the specimens of this species obtained were considerably under the medium size for the species, and the most of them were quite small. The several localities at which they were dredged is as follows:

Station 2129; latitude 19° 56′ 04″ N., longitude 75° 48′ 55″ W., 274 fathoms (7480).

Station 2135; latitude 19° 55′ 58″ N., longitude 75° 47′ 07″ W., 250 fathoms (7477).

Station 2152; 2½ miles N.W. of Havana Light, Cuba, 387 fathoms (7485).

Station 2154; latitude 23° 10′ 16″ N., longitude 82° 22′ 54″ W., 310 fathoms (7476).

Station 2157; latitude 23° 10′ 04″ N., longitude 82° 21′ 07″ W., 29 fathoms (7478).

Station 2161; latitude 23° 10′ 36″ N., longitude 82° 20′ 28″ W., 146 fathoms (7488).

Station 2162; latitude 23° 10′ 30″ N., longitude 82° 20′ 25″ W., 122 fathoms (7482).

Salenia Pattersoni, A. Agassiz.

Bull. Mus. Comp. Zool., vol. v, p. 187, fig. 1, pl. v, 1878; Mem. Mus. Comp. Zool., vol. x, No. 1, p. 13, pl. iv, v, vi, 1883.

Obtained at the following localities:

Station 2159; latitude 23° 10′ 39″ N., longitude 82° 20′ 08″ W., 98 fathoms; one specimen (8405).

Station 2162; latitude 23° 10′ 30″ N., longitude 82° 20′ 25″ W., 122 fathoms; one specimen (7049).

Station 2163; latitude 23° 10′ 31″ N., longitude 82° 20′ 29″ W., 133 fathoms; one specimen (7050).

Station 2164; latitude 23° 10′ 39″ N., longitude 82° 20′ 29″ W., 192 fathoms; two specimens (7051).

Station 2166; latitude 23° 10′ 36″ N., longitude 82° 20′ 30″ W., 196 fathoms; one specimen (7052).

Station 2167; latitude 23° 10′ 40″ N., longitude 82° 20′ 30″ W., 201 fathoms; one specimen (8404).

Salenia varispina, A. Agassiz.

Station 2117; latitude 15° 24′ 40″ N., longitude 63° 31′ 30″ W., 683 fathoms; four small specimens (8402).

Station 2118; latitude 13° 32′ 40″ N., longitude 62° 54′ W., 690 fathoms; one small specimen (8401).

Station 2127; latitude 19° 45′ N., longitude 75° 04′ W., 1639 fathoms; a fine series of specimens (8403).

Cœlopleurus floridanus, A. Agassiz.

Station 2164; latitude 23° 10′ 39″ N., longitude 82° 20′ 29″ W., 192 fathoms; two specimens (7048).

Station 2166; latitude 23° 10′ 36″ N., longitude 82° 20′ 30″ W., 196 fathoms; one specimen (7047).

Station 2167; latitude 23° 10′ 40″ N., longitude 82° 20′ 30″ W., 201 fathoms; one specimen (8398).

Diadema setosum, Gray.

This species was collected at the following localities:

Key West, Florida; one specimen (7497).

St. Thomas; several specimens from the shore, and from shallow water by dredging (7493, 7494, 7495, 8431). These form a very complete series, ranging from the young to large individuals.

Old Providence Island; several large specimens (7492, 7496).

Curaçao; one small specimen (8430).

Station 2139; latitude 17° 52′ N., longitude 76° 45′ 30″ W., 215 fathoms; one small specimen (8429). The spines of this specimen are banded, as in most of the young specimens from the shore, but the darker bands are of a light reddish brown color instead of the customary bluish black. This same color occurs, however, to a slight extent on some of the shore specimens.

Aspidodiadema antillarum, A. Agassiz.

Bull. Mus. Comp. Zool., vol. viii, p. 73, 1880.

A fine series of this species was dredged at station 2127; latitude 19° 45′ N., longitude 75° 04′ W., 1,639 fathoms (8396).

Aspidodiadema Jacobyi, A. Agassiz.

Bull. Mus. Comp. Zool., vol. viii, p. 74, 1880.

Station 2131; latitude 19° 56′ 44″ N., longitude 75° 50′ 49″ W., 202 fathoms; one specimen (8392).

Station 2134; latitude 19° 56′ 06″ N., longitude 75° 47′ 32″ W., 254 fathoms; one small specimen (8394).

Station 2143; latitude 9° 30′ 45″ N., longitude 76° 25′ 30″ W., 155 fathoms; several specimens (8395).

Station 2164; latitude 23° 10′ 39″ N., longitude 82° 20′ 29″ W., 192 fathoms; one specimen (8393).

Phormosoma placenta, Wyv. Thoms.

A large number of specimens were dredged at station 2143; latitude 9° 30′ 45″ N., longitude 76° 25′ 30″ W., 155 fathoms (8425); and two specimens were obtained at station 2117; latitude 15° 24′ 40″ N., longitude 63° 31′ 30″ W., 683 fathoms (8424).

Echinometra subangularis, Desml.

Key West, Florida; a single small specimen (7226).

St. Thomas; a large series, ranging from small to medium size (7227, 7374).

Old Providence; several specimens of medium size (7228, 7375).

Curaçao; several small specimens (7376).

Sabanilla; five large specimens (7230, 7377).

Echinometra viridis, A. Agassiz.

A single large specimen was obtained at St. Thomas (7229), and a large series, showing considerable range in size, from Jamaica (7225, 7378). They all belong to the variety *plana*, having a somewhat flattened test, and long, rather slender spines.

There is much variation in the color of the spines which, toward the base, are frequently of a light drab (hay color), changing to greenish or a distinct green toward the tips, the latter being almost invariably marked with dark purple for a greater or less distance. The principal deviations from the above coloration depend upon the extent to which the green approaches the base of the spine, and the intensity of that color, becoming sometimes a dark olive green. The drab color is always apparent at the base of the spines, and the milled head is always whitish.

Toxopneustes variegatus, A. Agassiz.

Key West, Florida; one small specimen, var. *carolinus* (8410).

Island of St. Thomas; numerous specimens, with long, slender spines and a greenish color, from the shore (7516, 8408); one young specimen dredged in shallow water (8407).

Jamaica; a series of specimens, similar to those from St. Thomas (8409).

Island of Curaçao, off the coast of Venezuela; three specimens (8406, 8827), one of which (8827) is of unusually large size. This large specimen measures 90^{mm} in diameter and 46^{mm} in height, and has 27 coronal plates in the interambulacra; the anal system is 9^{mm} in diameter, and the actinostome 26^{mm}. The primary spines on the dorsal surface are about 12^{mm} in length, and at the ambitus about 16^{mm}. The bare median interambulacral space is very broad, and reaches to the ambitus.

Sabanilla; two specimens of medium size, with comparatively short and slender spines (8826).

San Antonio, Cuba; one very young specimen, referred doubtfully to this species (8411).

Station 2138; latitude 17° 44′ 05″ N., longitude, 75° 39′ W., 23 fathoms; one specimen (8415).

Station 2159; latitude 23° 10′ 39″ N., longitude, 82° 20′ 08″ W., 98 fathoms; three specimens (8416).

Station 2164; latitude, 23° 10′ 39″ N., longitude, 82° 20′ 29″ W., 192 fathoms; one specimen (8413).

Station 2166; latitude 23° 10′ 36″ N., longitude, 82° 20′ 30″ W., 196 fathoms; one specimen (8414).

Station 2167; latitude 23° 10′ 40″ N., longitude 82° 20′ 30″ W., 201 fathoms; two specimens (8412).

The specimens obtained from the several dredging stations were all of very small size.

Hipponoë esculenta, A. Agassiz.

Key West, Fla.; one very large specimen (8426).

St. Thomas; several specimens (8828).

Old Providence Island; one specimen (8830).

Island of Curaçao; one small specimen (8427).

Sabanilla; one specimen (8829).

The specimens from these several localities exhibit considerable variation in structure, though there is no difficulty in referring them all to this species.

Echinocyamus pusillus, Van Ph.—

Several dead specimens were obtained at station 2150; latitude 13° 34′ 45″ N., longitude 81° 21′ 10″ W., 382 fathoms (7116).

Echinanthus rosaceus, Gray.

Numerous fine specimens of this species were dredged in shallow water at St. Thomas (8419, 8420). One living specimen was obtained at San Antonio, at the western extremity of Cuba (8418), and one dead specimen at Key West, Fla. (8417).

Mellita sexforis, A. Agassiz.

A single living specimen was obtained at Old Providence Island (8423).

Encope emarginata, L. Agassiz.

A fine series of specimens in good condition was collected at Sabanilla (8421, 8422).

Homolampas fragilis, A. Agassiz.

Two specimens, apparently belonging to this species, were obtained at station 2117; latitude 15° 24′ 40″ N., longitude 63° 31′ 30″ W., 683 fathoms (8397). One is comparatively perfect, the other very much broken. The perfect specimen is much larger than any which Mr. Agassiz seems to have had the opportunity of examining, measuring 26 ^{mm} in longitudinal diameter, and presents several characters resembling more those of *H. fulva** than would be indicated by Mr. Agassiz's original description of this species.

There are four genital openings placed rather more closely together than represented in Mr. Agassiz's figures of *fulva*, and, for the most part, two perforations instead of one to each ambulacral plate on the dorsal side. There are no large primary tubercles and spines in the posterior interambulacral area, but in the postero-lateral interambulacra, on each side, there are six such tubercles, having a somewhat concentric arrangement, in three rows, with reference to the abactinal system, there being one spine above, two in the second row, and three in the lower. These tubercles are quite closely placed, especially those of each row, and several of their spines, all of which are strongly curved, reach to or slightly beyond the posterior end of the test.

In the anterior interambulacra there are also six large tubercles, two arranged vertically above and two pairs below. Their spines are but slightly smaller than those above described. The entire arrangement of primary tubercles is much more anterior than in *fulva*, as figured by Mr. Agassiz, being included within the anterior two-fifths of the test in

*A. Agassiz, Report on the Echinoidea of H. M. S. Challenger, 1881, p. 164.

length. The actinostome is more transverse than in Mr. Agassiz's figures of this species.

Further details cannot be safely stated without a comparison of specimens.

Linopneustes longispinus, A. Agassiz.

Bull. Mus. Comp. Zool., Cambridge, vol. viii, No. 2, p. 82, 1880.

One large specimen in fine condition was dredged at station 2157; latitude 23° 10′ 04″ N., longitude 82° 21′ 07″ W., 29 fathoms (8428).

Brissopsis lyrifera, L. Agassiz.

One specimen of medium size was dredged at station 2145; latitude 9° 27′ N., longitude 79° 54′ W.; 25 fathoms (7117).

Aceste bellidifera, Wyv. Thom.

The Voyage of the Challenger, Atlantic, vol. i, p. 376 (Eng. ed.), 1877. A. Agassiz, Report on the Scientific Results of the Voyage of H. M. S. Challenger, Zoology, vol. iii, part ix, p. 195, 1881. Verrill, Am. Journ. Sci., vol. xxviii, p. 382, 1884.

Two specimens of this species were dredged at station 2117; latitude 15° 24′ 40″ N., longitude 63° 31′ 30″ W., 683 fathoms (7115); and one very small specimen, doubtfully referred to this species, was obtained at station 2150; latitude 13° 34′ 45″ N., longitude 81° 21′ 10″ W., 382 fathoms (8399). The specimens from station 2117 are very unequal in size, one measuring about 26^{mm} in length, and the other about 10^{mm}. The prevailing color of the smaller specimen is a very light-purplish gray, while the peripetalous faciole is colored dark purple, and forms on the dorsal surface a distinct pentagonal figure, broken at the anterior end. In the larger specimen this fasciole is not colored differently from the remainder of the test, which is of about the same shade as in the smaller specimen, though there are some undefined darker markings on the dorsal surface near the posterior end. The specimen from station 2150 is only about 5^{mm} in length, and differs considerably from the larger specimens. It may possibly be the young of some other species.

This species was obtained by H. M. S. Challenger, in the Atlantic Ocean, only in the vicinity of the Canaries, and in latitude 35° 39′ S. It was not collected at all by the Coast Survey steamer Blake in its explorations of the Gulf of Mexico and Caribbean Sea. It has, however, been dredged by the steamer Albatross off the eastern coast of the United States, at a depth of 1,467 fathoms (Verrill, *loc. cit.*).

Agassizia excentrica, A. Agassiz.

A single living specimen, measuring about 10^{mm} in longitudinal diameter, was obtained at station 2159; latitude 23° 10′ 39″ N., longitude 82° 20′ 08″ W., 98 fathoms (8400).

AN ACCOUNT OF RECENT CAPTURES OF THE CALIFORNIA SEA-ELEPHANT, AND STATISTICS RELATING TO THE PRESENT ABUNDANCE OF THE SPECIES.

By CHARLES H. TOWNSEND.

On October 14, 1884, I sailed from the port of San Diego, California, in the schooner Laura, of San Francisco, Captain Morrison, bound on a cruise in search of specimens of the sea-elephant (*Macrorhinus angustirostris*) for the Smithsonian Institution.

Previous to leaving San Francisco I had made special arrangements with the owners of the vessel there for the trip, which was undertaken under the direction of Professor Baird.

During a cruise of two months along the peninsula of Lower California, from San Diego to Magdalena Bay, 600 miles south of the United States and Mexican boundary, we explored carefully the intermediate coast-line and all the outlying islands, including Guadalupe, 160 miles off the coast, in about latitude 28° 45′.

As predicted by the captain of the Laura, the desired animals were found only at one place. This was a point on the mainland, 50 miles south of Cerros Island, and known to seal hunters as "Elephant Beach." The locality is indicated on the charts as San Cristobal Bay.

At this isolated and desolate place, on October 20, we discovered three young sea elephants sleeping on the sandy beach. As this locality had long been known to seal hunters as a favorite resort of the species, and is now known as the only remaining breeding rookery, the captain counseled that these three should for the present remain undisturbed, thinking that their presence on the rookery might induce larger animals to haul out there later in the season when we should return. After observing their actions on the beach and in the water for some time, we proceeded on our search farther south, leaving three of the men to camp near by and take possession of all animals that might appear in the mean time. Returning to this place a month later (November 18), we found but one of the three sea-elephants we had left there remaining, a female, which we killed. Three had been seen by the men on one occasion, but were probably the same ones we had left there.

Although we remained at San Cristobal Bay a week longer, no more animals appeared, and, after arranging with the captain to visit the place late in December and make a last attempt to procure the desired specimens for me, we sailed for San Diego, where I took the steamer for San Francisco.

While cruising about in search of sea-elephants we killed numbers of the black sea-lion (*Zalophus californianus*), and in preparing the skins and skeletons of these I had the help of the crew, and took special pains to instruct them in the preservation of such specimens.

The last visit was made to the Elephant Beach December 31, and fifteen sea-elephants were killed and preserved in the best manner. There being no indications of others, the Laura proceeded to San Francisco. Of these fifteen animals only one was a male, which measured nearly 12 feet in length. The rest, with the exception of two pups, each about a week old and over 4 feet long, were females, averaging 10 feet in length.

Thirty or forty years ago the sea-elephant was found at many places on the coast between Santa Barbara Islands and Cape St. Lucas, but continual persecution has almost exterminated the species.

I conversed with a number of old men at San Diego and elsewhere, who were in the seal-oil business in its palmiest days, and learned that about the year 1860, the species became so scarce that their pursuit could no longer be carried on with profit, and that from about 1865 to nearly 1880 none of the animals were seen to the best of their knowledge, except stragglers observed at Guadalupe and Benita Islands. They were accordingly reported as extinct. My informants thought that, notwithstanding the fact of the sea-elephant having been found in limited numbers within the last few years, it was doomed to speedy extinction. I took pains to ascertain how many animals had been found by the different vessels that have searched for them since their reappearance at their former haunts, and collected the information which is given in the following record:

1880. Schooner San Diego killed thirty sea-elephants at the Elephant Beach, at San Cristobal Bay, during the fall and winter.

1882. Schooner San Mateo, of San Pedro, killed forty sea-elephants at Elephant Beach. Six live young ones were brought to San Francisco by a certain Captain Smith. What disposition was made of them was not ascertained.

1883. Schooner ——, of San Francisco, Captain Lee, arriving at Elephant Beach October 9, found sixty sea-elephants. Of these the majority were young bulls; fourteen were bulls of large size, and there was one young one three weeks old. Other animals hauled out there later in the season, and the schooner left, December 23, loaded with the oil of one hundred and ten sea-elephants over one year old.

Schooner San Diego found four good-sized bulls at Guadalupe Island. Date not ascertained.

1884. Sloop Liberty, of San Diego, Captain Morrison, arrived at the beach January 25, and killed thirty-three sea-elephants. Returned in March and killed sixty over one year old, leaving a few females and young undisturbed.

Schooner City of San Diego, of San Diego, arrived in May, and, finding no large animals, killed the females and young animals spared by the crew of the Liberty, forty in all.

Schooner Laura, of San Francisco, Captain James Morrison, the writer being on board, arrived at San Cristobal Bay and saw three young sea-elephants. After unsuccessful searching elsewhere, returned,

November 18, and killed a female, the only animal on the beach. After another trip as far north as San Diego returned again, December 31, and found fifteen animals, all of which were carefully preserved and are now in the Smithsonian Institution.

From this it would appear that this interesting and valuable animal has heavy odds to encounter in its struggle for existence. No sooner were the three hundred or more that had appeared during the years of their seclusion discovered than they were speedily made away with. That a pretty clean sweep had been made of them was evident from the meagre results of our own careful search, during which we not only inspected the coast-line, but circumnavigated the islands of the region both large and small. The herds of black sea-lions (*Zalophus*) inhabiting many places were also looked over for stray sea-elephants that might be among them. The great number killed at the old rookery at San Cristobal Bay in the fall and winter preceding our visit was, no doubt, the principal cause of their scarcity.

I had but little opportunity for observing their habits. Having had considerable experience with other species of seals during the summer, I was struck at once by the different mode of progression employed by these animals. Like the true *Phocidæ*, they do not throw their hind flippers forward in crawling, nor indeed lift them from the ground at all, but by arching the back the hind parts are dragged forward and used as a prop to serve in shoving the forequarters forward. Compared with it in this respect *Eumetopias* and *Zalophus* are animals of remarkable agility. Even when forced to exert themselves the hind limbs were never turned forwards, but literally trailed in the sand behind the body as if they were paralyzed. The black sea-lion especially is capable of making effective leaps and plunges when hurried towards the water, contrasted with which the retreat of the sea-elephant seemed a feeble crawl, the breast apparently never being raised from the ground.

Old sealers told me that in all their experience with the sea-elephant they had never observed it swimming far out at sea as sea-lions often do; in fact that they had never seen it outside the surf. This may have been due to the fact that they are less conspicuous in their actions. In protruding their heads above the surface, they are very quiet, making no blowing noises as sea-lions do. A favorite attitude in the water is to float about with the nose and hind flippers only above the surface.

The smaller animals are apparently liable to be attacked by sharks. The specimen we obtained November 18 (No. 233) was disfigured by a great gash on the rump, in which the print of shark's teeth was plainly evident. I was assured by the men that fully one-fourth of the females they had killed at San Cristobal Bay bore unmistakable traces of the teeth of sharks. The specimen referred to was found to be terribly infested with abdominal parasites, which I have never seen in any other pinniped. They were white thread-like worms, 3 or 4 inches in length. The eyes in the sea-elephant appear to be larger and more bulging than

in their congeners. Where they are found in abundance they are easier to kill than the more agile seals. They also produce more oil in proportion to their size. They have had no chance during late years to attain large size, and it is doubtful whether they will ever again be found as large as that one which Captain Scammon found to measure 22 feet in length. He also mentions one measuring 18 feet, which yielded 210 gallons of oil. The largest bulls killed by Captains Lee and Morrison in the seasons of 1883 and 1884 averaged but 90 gallons of oil each. I found a weather-worn, but still well preserved, skull on the Elephant Beach which measures exactly 2 feet. This indicates an animal of very great size, having probably a length of 20 feet.

While at Magdalena Bay I learned of their former occurrence at San Hipolito Bay, which may be about half way between Cerros Island and Cape St. Lucas. From the great number of weather-worn skulls and other bones found at various places it is evident that their former abundance has not been overestimated. The beach at San Cristobal Bay was lined with bones, and we found them at many places on Cerros, Benita, and Natividad Islands. The new-born young that were met with in 1883–'84 were dropped at various times between November 1 and February 1.

The sea-elephant without doubt affects the vicinity of the roughest breakers. We seemed always to find its bones opposite places so rough that we could not land without danger. Captain Scammon mentions finding ruins of the stone huts built by the seal hunters of half a century ago. We met with these, too, but I should also add that we found many a nameless grave where the body of some unfortunate man, drowned in the surf, had found a last resting place when the sea gave up its dead. At San Cristobal Bay we often had our boats half filled with water in landing. It was not safe in fact to land through the surf there in any other boat than a dory, while we were compelled to anchor our schooner at Turtle Bay, nearly 20 miles distant. After these wettings some one had usually a harrowing tale of death by drowning to relate, and could adduce evidence thereto by pointing out some lonely grave.

DESCRIPTION OF A NEW SPECIES OF BOAT-BILLED HERON FROM CENTRAL AMERICA.

By **ROBERT RIDGWAY.**

Cancroma zeledoni, sp. nov.

SP. CHAR.—Resembling *C. cochlearia*, (Linn.), but differing in having the neck and breast deep buff instead of ashy white; the under surface of the primaries ashy instead of white; the upper parts much deeper pearl-gray, and the crest far less developed.

Hab.—Central America, from southern and western Mexico to Veragua.

Adult (type, No. 51388, Mazatlan, Mexico, February, 1868; F. Bischoff): Above, pure French-gray, somewhat paler and more écru on the primaries. Pileum (except forehead and fore part of the crown) including occipital crest, black, with a glaucous or chalky cast in certain lights. Forehead, pale grayish buff; superciliary and postocular regions and feathers bordering the base of the gular pouch, white; sides of head pale drab or grayish buff, passing gradually into deeper, more pinkish, buff on the neck, the whole foreneck, including jugular plumes, clear, deep vinaceous-buff, or pinkish-buff. Breast, abdomen, anal region, and lower tail coverts, rich vinaceous-cinnamon, lighter and more buffy on the abdomen, duller and more olivaceous on the tibiæ. Lining of the wing dull black; edge of wing buff, becoming paler on the carpometacarpal region. Sides and flanks blackish-slate, with a strong glaucous or chalky cast in certain lights. Gray of the back separated from the light drab or grayish-buff of the neck by a narrow bar of black. Wing, 10.50; tail, 4.80; culmen, 3.20; depth of bill, .95; width of bill, 1.75; tarsus, 2.75; middle toe, 2.35.

Twelve examples, from various parts of southern and western Mexico, Guatemala, Nicaragua, Costa Rica, and Veragua, differ constantly and conspicuously from two South American specimens (one from the mouth of the Amazon, the other from British Guiana) in the characters pointed out above. The specimen described and selected as the type of the new species is the lightest colored example among the twelve. A binomial appellation is in this case preferred to a trinomial, for the reason that there is no indication of probable intergradation, the most southern specimen of the Central American form (from Veragua) being, on the contrary, the darkest of the whole lot.

The species is named in honor of Señor Don José C. Zeledon, the accomplished ornithologist, of San José, Costa Rica.

DESCRIPTION OF A NEW HAWK FROM COZUMEL.

By ROBERT RIDGWAY.

Rupornis gracilis, sp. nov.

SP. CHAR.—Similar to *R. ruficauda griseicauda*, but decidedly smaller, and with the thighs and under wing-coverts nearly or quite immaculate, instead of distinctly barred and spotted, respectively. Wing, 8.00–8.80 (average of ten specimens, 8.44); tail, 6.00–6.30 (average, 6.13); culmen, .60–.72 (average, .67); tarsus, 2.20–2.40 (average, 2.33); middle toe, 1.05–1.20 (average, 1.17).

Hab.—Cozumel I., Yucatan.

Compared with eleven specimens of *R. ruficauda griseicauda* from various parts of Mexico, including four from Yucatan, the Cozumel birds are found to differ constantly in the characters pointed out above. The measurements of the series of *R. griseicauda* are as follows: Wing, 8.70–

10.00 (average of eleven specimens, 9.19); tail, 6.20–7.10 (average, 6.62); culmen, .70–.82 (average, .75); tarsus, 2.35–2.65 (average, 2.54); middle toe, 1.15–1.30 (average, 1.24).

The specimens of this new form (including eight examples in alcohol) were collected by the naturalists of the United States Fish Commission steamer Albatross, Capt. Z. L. Tanner, commander.

ON A NEW SPECIES OF PORPOISE, PHOCÆNA DALLI, FROM ALASKA.

By FREDERICK W. TRUE,
Curator of the Department of Mammals.

The species of *Phocæna* hitherto described are seven in number. These are—

Phocæna communis, Lesson.
Phocæna vomerina, Gill.
Phocæna brachycion, Cope.
Phocæna lineata, Cope.
Phocæna spinipinnis, Burmeister.
Phocæna tuberculifera, Gray.
Phocæna pectoralis, Peale.

The *P. pectoralis* of Peale, as I shall endeavor to prove in another communication, is in reality a *Lagenorhynchus*, and probably synonymous with *L. electra*, Gray. *P. tuberculifera* of Gray was finally admitted by that author to be only a variation of *P. communis*. The opinion has lately been expressed by Professor Flower that the last named species is probably cosmopolitan, and that *P. brachycion* and *P. vomerina* are synonymous with it.* If this view is correct, and I am inclined to believe that it may be, the known species of *Phocæna* will be reduced to three, namely, *P. communis*, *lineata*, and *spinipinnis*. To this list I am enabled to add a new species, through the kindness of Mr. William H. Dall, who has placed at my disposal his notes upon and drawings of two specimens of a peculiar porpoise belonging to the genus, captured off the coast of Alaska in 1873. The skeleton of one of these specimens was sent to the Army Medical museum in this city, where it was unfortunately destroyed by rats. The skull, however, was preserved and is now in the possession of the National Museum. The second specimen, which I shall now describe, was one of a school of five or six met with in the strait west of Adakh Island, one of the Aleutian group, August 13, 1873. It proved to be a male.

PHOCÆNA DALLI, sp. nov. (Plates II–V.)

Length 6 feet. General color black. A cordate area of white occupies the belly and lower half of the sides, from a point in line with anterior margin of the dorsal fin to one considerably behind the vent. This area is faintly streaked with very fine dark lines, especially nu-

* P. Z. S., London, 1883, p. 505.

merous near the median line, but only visible on close inspection. The dorsal fin is tipped with white. Eye blackish.

Head sloping. Lower jaw protruding slightly beyond the upper. Dorsal fin moderately high and falcate, its front edge furnished with five faintly-marked rugosities. Pectorals as in *P. communis*. Dorsal and ventral margins of the body, between the vent and the origin of the flukes, raised into a prominent thin ridge.

Skull as in *P. communis*, but the beak relatively shorter, and the temporal fossæ smaller. The maxillaries are also shorter proximally, and the mandible less deep between the coronoid process and angle. Numerous other differences of proportion will be found upon examination of the table on p. 98. The symphysis mandibuli is prolonged anteriorly into an obtuse point. Teeth $\frac{23}{27}$, very small. The crown measures .065 by .05 inches, and is compressed as in other Phocænas, though in a less degree; the margin is not indented.

Vertebral formula as follows: C. 7; D. 14 (or 15*); L. 27; Ca. 49=97 (or 98). All the cervicals united, as are also the last four caudals. First thirty caudals with chevron bones.

The pectoral corresponds closely to that of *P. communis*. Five carpals are present. The formula of phalanges is as follows: I, 1; II, 6; III, 4; IV, 2. The two distal phalanges of fingers 2 and 3 and the outermost of finger 4 are very imperfectly ossified.

I deem it eminently fitting that this species should be dedicated to my friend, Mr. William H. Dall, not alone on account of his prominence as a zoologist, but also because the specimens and notes from which the description has been drawn are the fruits of his labor.

COMPARISON OF PHOCÆNA DALLI WITH OTHER SPECIES.

The three main features in which *P. Dalli* differs from the remaining species of the genus are (*a*) the coloration; (*b*) the shape of the dorsal fin; and (*c*) the number of vertebræ. In all these characters it shows an approximation to the species of *Lagenorhynchus*.

In *P. spinipinnis* we have, according to Burmeister, a species which is entirely black. *P. communis* and *P. lineata*, on the contrary, are dark or black upon the upper or dorsal surface of the body, and white or light upon the lower or ventral surface, the two opposite colors grading into each other on the sides. The coloration of *P. Dalli* differs from both these styles in that the white or light area is confined to the posterior half of the ventral surface, and is sharply defined from the surrounding black color.

In his recent admirable paper upon the *Delphinidæ* (Proc. Zool. Soc., 1883, p. 505), Professor Flower recognizes the triangular shape of the dorsal fin as among the salient characters of the genus *Phocæna*. Its shape is such in the species hitherto described, but in *P. Dalli* the tip is recurved, and the posterior margin concave, giving the fin approximately

*One dorsal vertebra was crushed by the harpoon.

Vol. VIII, No. 7. Washington, D. C. May 23, 1885.

the falcate form existing in *Delphinus*. The rugosities on the upper margin appear to be similar to those which exist in other species of *Phocœna*, and which are most strongly developed in *P. spinipinnis*.

In the great number of its vertebræ, as already remarked, *P. Dalli* shows on important similarity to the *Lagenorhynchi*. The vertebral formulæ of the different species of *Phocœna* and of one of *Lagenorhynchus* are as follows:

Species.	C.	D.	L. Ca.	Total.
Phocœna communis	7	13	14 32	=66*
Phocœna lineata	7	11 (or 12)	45	=63 (or 64)
Phocœna Dalli	7	14 (or 15)	27 49	=97 (or 98)
Lagenorhynchus albirostris	7	14	67	=88*

* Flower, Cat. Osteol., College of Surgeons, pt. ii. 1884, pp. 570 and 582.

In view of the existence of these three characters in a species otherwise evidently allied to *P. communis*, it would appear to be necessary to modify the diagnosis of the genus, and to base the latter simply upon the peculiar shape of the teeth and the form and position of the pterygoids.

Mr. Dall states in his notes that the species under consideration is recognized by the Aleuts as distinct from the smaller bay porpoise or puffing pig, *P. vomerina*, Gill (?=*P. communis*), which is also found about the Aleutian Islands. The latter species is called *al-ā-tŭkh*, while *P. Dalli* known as *kūd-āh'-tikh*, the word *ah-tŭkh*, as Mr. Dall further explains, signifying whales in general.

Measurements of the exterior of a specimen of Phocœna Dalli captured off Adakh Island, August 13, 1873.

[These measurements are in straight lines, the curves of the body being excluded.]

	Inches.
Total length	72.0
Tip of lower jaw to corner of mouth	3.5
Tip of lower jaw to center of eye	7.0
Tip of lower jaw to ear	9.5
Tip of lower jaw to front edge of pectoral at its insertion	11.0
Tip of lower jaw to back edge of pectoral at its insertion	14.0
Tip of lower jaw to anterior edge of blow-hole	9.0
Eye to spout-hole (vertical)	4.0
Across base of pectoral	5.5
Anterior base of pectoral to tip	8.0
Posterior base of pectoral to tip	5.75
Tip of lower jaw to anterior boundary of the white area	27.3
Spout-hole to anterior edge of dorsal	18.5
Height of dorsal	6.0
Length of base of dorsal	10.5

Length posterior margin of dorsal	7.5
Tip of lower jaw to genital slit	43.0
Length of genital slit	3.0
Genital slit to anus	4.25
Anus to notch of the flukes	22.75
Breadth of flukes (transverse)	18.5
Length of flukes (antero-posterior)	5.25
Breadth of narrowest part of tail before the flukes	1.75
Height of body at same point	3.5
Length of eye	.75
Width of spout-hole	1.87
Extension of white area posterior to the anus	6.5
Length of white area along the belly	18.0
Width of head at corner of the mouth	5.5
Depth of body 24 inches anterior to the flukes (at which point the keels are widest)	10.0
Depth 8 inches anterior to flukes	7.5
Navel to anterior end of genital slit	7.5

Measurements of the type skull of Phocœna Dalli, and of a skull of P. communis.

Measurements.	*P. Dalli*, Adakh Id., Alaska. Type.		*P. communis*, Eastport, Me. 9164.	
	Centim.	100ths.	Centim.	100ths.
Total length	33.3	100.0	26.0	100.0
Length of beak	14.0	42.0	11.7	44.5
Breadth of beak at base of notches	9.5	28.5	7.8	29.5
Breadth of beak at its middle	5.7	17.1	4.8	18.5
Breadth of intermaxillaries at same point	3.5	10.5	2.2	8.4
Greatest breadth between outer margins of intermaxillaries proximally	5.1	15.3	3.6	14.0
Length of tooth-line	12.7	38.1	9.8	37.5
Last tooth to base of maxillary notch	2.2	6.7	2.3	8.6
Tip of beak to anterior margin superior nasal opening	17.8	53.4	14.8	56.2
Tip of beak to end of crest of pterygoid	21.3	64.3	....	....
Breadth between orbital processes of frontal	16.5	49.5	12.2	46.8
Breadth between hinder margins of temporal fossæ	16.2	48.6	12.0	45.7
Length of temporal fossa	5.6	16.8	6.3	24.1
Depth of temporal fossa	2.6	7.8	4.2	16.1
Total length of mandible	25.5	76.6	....	....
Length of symphysis of mandible	3.8	11.4	....	....
Length of tooth-row of mandible	12.2	36.6	....	....
Depth between angle and coronoid process	5.7	17.1	....	....
Number of teeth	$\left(\frac{23-23}{27-27}\right)$	....	$\left(\frac{27-28}{?-?}\right)$	....

ON PEUCÆA MEXICANA (LAWR.) A SPARROW NEW TO THE UNITED STATES.

By ROBERT RIDGWAY.

In Dr. J. C. Merrill's "Notes on the Ornithology of Southern Texas," &c. (Proc. U. S. Nat. Mus., vol. i, p. 127), a species of sparrow is mentioned under the name of *Peucæa arizonæ*, which was "found in some abundance on a salt prairie about 9 miles from Fort Brown," and of which both specimen of the bird itself and its nest and eggs were obtained by Dr. Merrill. The species was referred by me to *P. arizonæ* with some doubt, satisfactory identification being almost out of the question on account of the rather poor condition of the specimens examined, while the examples of *P. arizonæ* with which they were com-

pared were in equally bad feather. The National Museum having subsequently acquired a much better series of *P. arizonæ*, a second comparison of the Texas bird has been made, the result being quite unexpected, since it proves to be identical with a Mexican form, apparently quite distinct from *P. arizonæ*, and to which the name *Coturniculus mexicanus* was given by Mr. George N. Lawrence, in 1867. The latter name was in the History of North American Birds (*ii*, p. 38, foot-note) referred as a synonym to *Peucæa botterii* Scl., of Eastern Mexico (Orizaba), a disposition which I am now convinced was erroneous. A second Mexican example of *P. mexicana* has been sent to the National Museum by Prof. A. Dugès, from Guanajuato, and proves to be so closely similar to Dr. Merrill's specimen, and also to the type of "*Coturniculus mexicanus*, as to leave no doubt as to their identity.

The synonymy of the species is as follows:

Peucæa mexicana (Lawr.).

Coturniculus mexicanus Lawr., Ann. Lyc. N. Y., viii, 1867, 474 (mountains of Colima).

Peucæa æstivais var. *botterii* B. B. & R., Hist. N. Am. B., ii, 1874, 38, foot-note (part). (Nec *Zonotrichia botterii* Scl., 1857.)

Peucæa arizonæ Ridgw. and Merrill, Pr. U. S. Nat. Mus., vol. i, 1878, 127 (near Fort Brown, Tex.). Nec *Peucæa æstivalis* var. *arizonæ* Ridgw., 1874.)

Peucæa mexicana Ridgw., M. S.

ON DEPOSITS OF VOLCANIC DUST AND SAND IN SOUTHWESTERN NEBRASKA.

By GEORGE P. MERRILL.

In January, 1885, there were received at the National Museum two samples of a fine sharp dust marked "silicic acid," and which were supposed by the sender, Mr. Henry Zahn, of Plattsmouth, Nebraska, to be hot spring or geyser deposits, and were therefore called by him "Geyserite." Mr. Zahn states that the dust is found in small deposits in Western Kansas, Nebraska, eastern Colorado, and Wyoming. Concerning the two samples sent he writes: "The deposit of the gray sample is located in Furnas County, southwestern Nebraska, nearly 2 miles south of the Republican River, on sections 8 and 9, township 3 north, range 21 west of the sixth principal meridian. The white sample is from Harlan County, adjoining Furnas on the east, sections 10 and 11, township 2 north, range 20 west, a mile south of the Republican River. The deposits of this material occur mostly in this State, on the Republican River, extending into Kansas. By taking a map you will see numerous creeks flowing from the north and south and forming this river. Into the larger creeks flow numerous rivulets. On these streamlets we find the deposits, always on the east side, excepting the deposits in Harlan County, which I find on both sides of the ravine. The deposits occur from Guide Rock west to State line. * * * The de-

posits are found in many places in semicircles from 4 feet high to 10 feet, in different-colored layers and quality, of an inch in thickness, resting on fine sand or sandy calcareous marls. The largest deposit I have seen I found about 100 steps in the circle, with dips of 3 degrees. On top is generally found calcareous limestone (?) 6 to 12 inches thick, then comes coarse gravel and sometimes loess only. * * * These deposits I would judge to be about 100 feet higher than the level of the river. The white deposit in Harlan County, I find since I first discovered it, extends a good way under the hill. A farmer dug a well 2½ miles east and south and found the same deposit 4 feet thick, 30 feet from the surface."

A glance at the samples was sufficient to convince the writer that they were not the result of geyser action, but were probably of volcanic origin. One was of almost chalky whiteness, very finely pulverized, and of a sharp, gritty feeling when rubbed between the fingers. The second was gray in color, slightly coarser, and had, even to the naked eye, a flaky appearance. Submitted to microscopic examination both samples were found to consist almost entirely of the minute particles of amorphous glass, such as originate from the fine pulverization of a glassy pumice, with only occasionally a fragment of a greenish mineral that was apparently hornblende.

The figures given below show the more common forms of these flakes. The actual size of the larger one is some 0.3^{mm} in diameter.

On writing a second time to Mr. Zahn that gentleman was kind enough to forward samples of the sandstone from the top of the deposits and also another sample such as is found "in some places on top and sometimes below the deposit, or in close proximity." Both were very friable, crumbling readily between the thumb and fingers. Submitted to the microscope they proved to be composed entirely of small cleavage plates of a triclinic feldspar, particles of a green hornblende, grains of iron ore, and numerous other grains, evidently feldspathic, but otherwise undeterminable. No quartz was observed. All were distinctly rounded, having evidently been waterworn. From these facts the present writer does not hesitate to pronounce all the deposits as of volcanic origin, *i. e.*, volcanic dust and sand, owing their present evenly stratified condition to the assorting agencies of water and atmospheric currents.

As, so far as the writer is aware, no deposits of this nature have heretofore been recognized east of the Rocky Mountain region, this instance seems worthy of the space here devoted to it.

NATIONAL MUSEUM, *April* 2, 1885.

ON THE INFLUENCE OF ATROPIA ON THE HEART.

By Dr. H. G. BEYER, U. S. N.,
Honorary Curator, Section of Materia Medica, U. S. National Museum.

Last winter, while engaged in studying the physiological action of atropia on the heart, I found among the many terrapins I had occasion to use one whose heart was in a peculiarly abnormal condition. The auricles were very large, larger in fact than the ventricle in diastole, and although contracting in rythmical sequence with relation to the ventricular systole, their contraction was barely perceptible, while the ventricle performed its work in a most satisfactory manner; that is to say, an attempt at contraction on the the part of the auricles was immediately followed by the ventricular systole. I determined, however, to proceed to isolate it in the usual manner and begin observations on it with atropia.

After the operation of inserting the inflow cannulas into the respective veins, and the outflow cannulas into the arteries, on allowing the nutrient blood-mixture to flow through the heart, no change in its condition was noticed. No lowering of the venous pressure would make the least difference, and even a venous pressure of only 0.5^{cm} was still sufficient to keep the auricles in their distended condition.

Hoping, nevertheless, to induce the auricles to perform their normal work, well oxygenated fresh nutrient blood-mixture was allowed to run through it for over two hours but still the condition remained unaltered.

A back flow of blood from the auricles into the venous cannulas and inflow tubes could be plainly seen to occur with each ventricular systole, showing the undoubted existence of a free and direct communication between ventricle and auricles and auricles and veins. Their respective valves, therefore, were clearly insufficient from the distended condition of the auricles. All the more surprising was the change which occurred when atropized blood was substituted for the normal nutrient blood-mixture, as the following record of the experiment will show.

The heart under observation, being clearly an abnormal one, and therefore not to be found in every terrapin, though it might perhaps be artificially produced without serious injury to the organ, I nevertheless, determined not to publish it until an opportunity offered itself for verifying the results attained.

I was fortunate enough to open a terrapin last January which presented a heart in a similar, if not identical, condition, and it was at once concluded to try atropia with the result of inducing the inactive auricles to perform their work and thus increase the entire amount of work done by the heart from 100 to 150 per cent.

Inasmuch as these two experiments are strikingly well calculated to throw important light on the stimulating influence exerted by atropin

on the heart's action, more especially on the auricular portion of it, which was in the two cases in point in a pathological condition of not infrequent occurrence in mammals and man, the publication of at least one of them was deemed justifiable.

For a review of the literature of the subject as well as for a description of my method of experimentation I must refer, in order to avoid repetition, to the studies from the Biol. Lab. Johns Hopk. Univ., vol. iii, No. 2, p. 73, and also to the last number of the Proceedings of the Naval Medical Society.

February 28, 1884. Experiment I. Terrapin 1065. Calf's blood and Ringer's saline 1:1. Cunulas in inferior vena cava, hepatic vein, pulmonary artery and left aorta. Venous pressure 3.5^{cm}. Arterial pressure 14^{cm}. Atropized blood 0.0025 : 100^{cc} of blood-mixture. During recovery the heart, being found specially delicate, low pressures have been used.

Time.	Rate per minute.	Work in c. c. per minute.	Temperature.	The circulating fluids were supplied to the heart at the time mentioned on the same line in column one.
4.10	35	14	19	
.11	...	...	...	On atropized blood.
.13	...	...	...	On normal blood-mixture.
.16	33	18	...	
.19	...	...	...	On atropized blood.
.20	...	...	...	On normal blood-mixture.
.22	22	32	...	Auricles contracting twice to ventricles once.
.25	31	21.5	...	Reappearance of previous condition, viz, both auricles much distended, left incompletely; right not at all contracting.
.30	31	19	19	Ventricles and auricles contracting simultaneously.
.31	...	...	...	On atropized blood.
.32	...	...	...	Normal blood.
.35	31	24	...	Both auricles contracting with much force.
.40	31	23	...	A perceptibly longer interval between auricular and ventricular systoles.
.41	...	...	...	On atropized blood.
.42	...	...	...	On normal blood-mixture.
.43	21	28	...	Both auricles contracting twice to ventricle once. Ventricle slightly larger than before, but contracting thoroughly.
.48	16	35	...	
.50	...	...	...	Ventricle suddenly becomes smaller again. Auricle distended
	...	...	18.5	as before, auricular and ventricular systoles simultaneous.
.53	32	12	...	On atropized blood.
.543	...	...	...	Off atropized blood, 31^{cc} through on n̄ blood.
.56	17	35	...	Both auricles again contracting. Ventricle expanding and
5.00	17	35	...	firmly contracting; two auricular to one ventricular beat.
.04	17	35	...	Immediately after this observation was taken, ventricle re-
.07	32	14	18.5	sumed its rapid rate. Auricles became distended as before.
.09	...	...	...	On atropized blood.
.11	...	...	...	On normal blood.
.12	...	...	...	Auricles again contracting. Ventricles dilating fully.
	...	...	...	
.16	16	33	18.5	
.21	16	33	...	
.24	...	...	...	Sudden return to former condition, viz, auricle distended, left scarcely at all contracting; right not at all. Ventricle half the size of auricle; auricular and ventricular systoles simul-
.25	32	13.5	18.5	taneous.
.27	...	...	...	On atropized blood.
.293	...	...	...	On normal blood-mixture.
.33	16	35	...	
.37	16	36	...	Ventricle largely dilating and slowly, but firmly, contracting. Left auricle contracting twice to right auricle and ventricle
.40	15	35	...	once.
.41	...	...	...	Sudden return to former condition.
.45	...	...	...	
.50	31	11.5	...	
.51	...	...	...	On atropized blood.
.54	...	...	...	On normal blood-mixture.
.57	16	35	18.5	Condition of heart identical with what has been described as
6.01	16	36	...	occurring under atropia.
.05	16	34	...	
10	16	33	18.5	

Time.	Rate per minute.	Work in c. c. per minute.	Temperature.	Remarks.
6.113	....	....	....	Abruptly passed into normal condition, with only an occasional expansion and subsequent strong contraction. Auricle twice the size of ventricle.
.13	31	13.5	....	
.14	....	....	....	On atropized blood.
.143	....	....	....	
.173	....	....	....	On normal blood-mixture.
.20	14	29	18	
.25	14	30.2	....	Condition of heart identical with what has been described under atropia.
.30	14	31.5	....	
.35	14	32	....	
.413	14	29	....	At the end of this observation passed back into normal condition; an occasional full expansion, followed by a long and strong contraction.
.46	26	16.5	....	
.50	25	19	....	During this observation four strong contractions occurred. Auricles largely distended. Ventricles small; not contracting as rapidly as before under normal blood.
.59	26	13.5	....	
7.09	25	13.5	18	
.15	24	14	....	On atropized blood.
.20	19	34	....	On normal blood; both auricles again contracting as before under atropized blood; ventricle slower than it did before; interval between auricular and ventricular systoles longer than in previous observations.
.40	16	32.5	....	
.43	17	28	....	
.47	19	27	....	
.51	17	25	....	Ventricle contracting oftener than auricles, which are slightly distended.
.57	18	28	18	
8.00	18	35	....	
.04	18	30.5	....	
.12	15	27.5	....	Heart working well in every respect; both auricles doing well, expanding and contracting perfectly; ventricle same; ventricular systole following auricular in good order.
.15	15	32	....	
.20	16	33	....	
.31	16	35.5	....	
.36	16	35	....	
.40	16	34.5	....	
.45	16	34.5	....	
.50	16	31.5	....	
.55	14	31.5	....	
9.00	15	33.5	....	
.05	15	29	....	Right auricle beginning to fall back, not emptying itself completely.
.14	14	35.2	....	
.20	12	31	....	
.25	12	31	....	
.30	10	27.5	....	
.35	8	23.2	18	Heart getting exhausted. Ended experiment.

EXPLANATION OF PLATE I.

Fig. 1 represents the tracings taken while the heart was working under the influence of atropized blood.

Fig. 2 shows tracings obtained while the heart was under the influence of normal nutrient blood-mixture; it is also intended to illustrate the promptness and completeness with which the heart passed out from under the influence of atropia, as can be seen on the left-hand side of the figure where part of the tracing taken under atropized blood is left on for the purpose of showing this.

CATALOGUE OF THE BIRDS OF COSTA RICA, INDICATING THOSE SPECIES OF WHICH THE UNITED STATES NATIONAL MUSEUM POSSESSES SPECIMENS FROM THAT COUNTRY.

By José C. Zeledon, of San José, Costa Rica.

PREFACE.

During a short residence in Washington, I have thought it advisable to avail myself of the excellent facilities afforded by the extensive ornithological collections of the United States National Museum, under the Smithsonian Institution, for the preparation of the present catalogue of the birds of Costa Rica, my native country, with a view to correct the several errors contained in a former one which I published at San José, in the Spanish language, in June, 1882, and to add all of the new species described since then, chiefly by Mr. Robert Ridgway, besides several species of adjoining countries which have recently been obtained within our limits by myself and others. It is intended as a preliminary publication of a work of a more extensive nature, on the same subject, which I have in contemplation, embracing descriptions of genera and species, besides notes on habits and geographical distribution.

The descriptions of *Vireolanius verticalis*, *Cyanocorax cucullatus*, and *Cancroma zeledoni* form the subject of special papers to be soon published by Mr. Robert Ridgway, curator of the department of birds of the United States National Museum. To this gentleman I feel under deep obligations for his very kind assistance in the preparation of this publication.

I have made use of some of the many important changes of nomenclature, published as well as unpublished, which we owe to the labors of the active investigator, Mr. Leonhard Stejneger.

On this, as on former occasions, Professor Baird, Secretary of the Smithsonian Institution, has kindly granted me the most free access to the collections. It gives me particular pleasure to acknowledge this fact, and to thank him very cordially.

J. C. Z.

[Species represented in the United States National Museum by Costa Rica specimens are marked with an asterisk (*).]

Order PASSERES.

(OSCINES.)

Family Turdidæ.

*1. Catharus melpomene (*Cab.*)
*2. Catharus frantzii *Cab.*
*3. Catharus gracilirostris *Salv.*
*4. Catharus mexicanus (*Bonap.*)
*5. Catharus fuscater (*Lafr.*)
6. Hylocichla mustelina (*Gm.*)
7. Hylocichla fuscescens (*Steph.*)
*8. Hylocichla aliciæ (*Baird*).
*9. Hylocichla swainsoni (*Cab.*)
10. Hylocichla ustulata (*Nutt.*)

*11. Turdus grayi *Bonap.*
*12. Turdus plebeius *Cab.*
*13. Turdus nigrescens *Cab.*
*14. Turdus obsoletus *Lawr.*
*15. Turdus tristis (*Sw.*)
16. Turdus infuscatus (*Lafr.*)
*17. Myadestes melanops *Salv.*

Family MIMIDÆ.

18. Mimus gilvus (*Vieill.*)
*19. Galeoscoptes carolinensis (*Linn.*)

Family CINCLIDÆ.

*20. Cinclus ardesiacus *Salv.*

Family SYLVIIDÆ.

*21. Polioptila bilineata (*Bonap.*)

Family TROGLODYTIDÆ.

22. Rhodinocichla rosea (*Less.*)
*23. Campylorhynchus capistratus (*Less*)
*24. Campylorhynchus zonatus (*Less.*)
*25. Cyphorinus lawrenci *Scl.*
*26. Microcerculus luscinia *Salv.*
*27. Henicorhina leucosticta (*Cab.*)
*28. Henicorhina leucophrys (*Tschudi*).
29. Thryophilus pleurostictus (*Scl.*)
*30. Thryophilus rufalbus (*Lafr.*)
*31. Thryophilus costaricensis *Sharpe.*
*32. Thryophilus thoracicus (*Salv.*)
*33. Thryophilus modestus (*Cab.*)
*34. Thryophilus semibadius (*Salv.*)
*35. Thryophilus zeledoni *Lawr.*
*36. Thryothorus hyperythrus *Salv. & God.*
*37. Thryothorus fasciativentris *Lafr.*
*38. Thryothorus atrogularis *Salv.*
39. Thryothorus maculipectus *Lafr.*
*40. Troglodytes intermedius *Cab.*
*41. Troglodytes ochraceus *Ridgway.*
42. Cistothorus polyglottus (*Vieill.*)

Family MNIOTILTIDÆ.

*43. Mniotilta varia (*Linn.*)
*44. Parula inornata *Baird.*
*45. Oreothlypis gutturalis (*Cab.*)
*46. Protonotaria citrea (*Bodd.*)
*47. Helminthophila peregrina (*Wils.*)
48. Helminthophila chrysoptera (*Linn.*)
*49. Helmitherus vermivorus (*Gm.*)
*50. Dendroica virens (*Gm.*)
51. Dendroica coronata (*Linn.*)
*52. Dendroica blackburniæ (*Gm.*)
53. Dendroica pennsylvanica (*Linn.*)
*54. Dendroica æstiva (*Gm.*)
55. Dendroica panamensis *Sund.*
56. Dendroica castanea (*Wils.*)
57. Dendroica cærulea (*Wils.*)
58. Dendroica maculosa (*Gm.*)
*59. Seiurus noveboracensis (*Gm.*)
*60. Seiurus auricapillus (*Linn.*)
*61. Seiurus motacilla (*Vieill.*)
62. Oporornis formosa (*Wils.*)
63. Geothlypis trichas (*Linn.*)
64. Geothlypis philadelphia (*Wils.*)
*65. Geothlypis macgillivrayi (*Aud.*)
66. Geothlypis caninucha *Ridgway.*
*67. Icteria virens (*Linn.*)
*68. Sylvania pusilla pileolata, (*Pall.*)
*69. Sylvania canadensis (*Linn.*)
70. Sylvania mitrata (*Gm.*)
*71. Basileuterus culicivorus (*Licht.*)
*72. Basileuterus mesochrysus *Scl.*
*73. Basileuterus melanogenys *Baird.*
*74. Basileuterus melanotis *Lawr.*
*75. Basileuterus leucopygius *Scl. & Salv.*
*76. Setophaga ruticilla (*Linn.*)
*77. Setophaga aurantiaca *Baird.*
*78. Setophaga torquata *Baird.*

Family HIRUNDINIDÆ.

*79. Progne chalybea (*Gm.*)
80. Petrochelidon swainsoni *Scl.*
*81. Petrochelidon pyrrhonota (*Vieill.*)
*82. Hirundo erythrogaster *Bodd.*
83. Tachycineta albilinea (*Lawr.*)
*84. Atticora cyanoleuca montana *Baird.*
*85. Stelgidopteryx uropygialis (*Lawr.*)
86. Cotile riparia (Linn.)

Family VIREONIDÆ.

*87. Vireosylvia olivacea (*Linn.*)
*88. Vireosylvia flavo-viridis *Cassin.*
*89. Vireosylvia josephæ *Scl.*

*90. Vireosylvia philadelphica *Cassin.*
91. Vireosylvia agilis (*Licht.*)
*92. Lanivireo flavifrons (*Vieill.*)
*93. Vireo pallens *Salv.*
*94. Vireo carmioli *Baird.*
*95. Hylophilus ochraceiceps *Scl.*
*96. Hylophilus decurtatus (*Bonap.*)
*97. Cyclorhis flavipectus *Scl.*
*98. Vireolanius pulchellus verticalis *Ridgway.*

Family PTILOGONATIDÆ.

*99. Ptilogonys caudatus *Cab.*
*100. Phainoptila melanoxantha *Salv.*

Family CŒREBIDÆ.

*101. Diglossa plumbea *Cab.*
*102. Dacnis ultramarina *Lawr.*
*103. Dacnis venusta *Lawr.*
*104. Chlorophanes guatemalensis *Scl.*
*105. Cœreba cyanea (*Linn.*)
*106. Cœreba lucida *Scl. & Salv.*
*107. Certhiola mexicana *Scl.*

Family TANAGRIDÆ.

*108. Chlorophonia callophrys (*Cab.*)
*109. Euphonia elegantissima (*Bonap.*)
*110. Euphonia affinis *Less.*
*111. Euphonia annæ *Cass.*
*112. Euphonia leuteicapilla (*Cab.*)
*113. Euphonia gracilis (*Cab.*)
114. Euphonia gnatho (*Cab*).
*115. Euphonia hirundinacea *Bonap.*
*116. Euphonia gouldi *Scl.*
*117. Euphonia minuta, *Cab.*
118. Euphonia laniirostris, *D'Orb & Lafr.*
*119. Calliste icterocephala *Bp.*
*120. Calliste guttata (*Cab.*)
*121. Calliste gyroloides (*Lafr.*)
*122. Calliste dowii *Salv.*
*123. Calliste larvata *Du Bus.*
124. Calliste florida *Scl & Salv.*
125. Calliste lavinia *Cass.*
*126. Tanagra cana *Sw.*
*127. Tanagra palmarum *Max.*
*128. Ramphocelus passerinii *Bonap.*
*129. Phlogothraupis sanguinolenta *Less.*
*130. Pyranga erythromelas *Vieill.*
*131. Pyranga leucoptera (*Trud.*)
*132. Pyranga rubra (*Linn.*)
*133. Pyranga bidentata *Sw.*
*134. Pyranga testacea *Scl. & Salv.*
*135. Phænicothraupis fuscicauda *Cab.*
*136. Phænicothraupis vinacea *Lawr.*
*137. Chlorothraupis carmioli (*Lawr.*)
*138. Lanio leucothorax *Salv.*
*139. Lanio melanopygius, *Ridgway.*
140. Eucometis spodocephala (*Bonap.*)
*141. Eucometis cassini (*Lawr.*)
*142. Tachyphonus luctuosus *Lafr. & D'Orb.*
*143. Tachyphonus delattrii *Lafr.*
*144. Tachyphonus xanthopygius *Scl.*
145. Tachyphonus melaleucus (*Sparm.*)
*146. Tachyphonus chrysomelas *Scl. & Salv.*
*147. Tachyphonus nitidissimus *Salv.*
*148. Chlorospingus albitemporalis (*Lafr.*)
*149. Chlorospingus pileatus *Salv.*
*150. Buarremon brunneinuchus (*Lafr.*)
*151. Buarremon assimilis (*Boiss.*)
*152. Buarremon gutturalis (*Lafr.*)
*153. Buarremon crassirostris *Cass.*
154. Buarremon albinucha (*Lafr. & D'Orb.*)
*155. Buarremon capitalis (*Cab.*)
*156. Buarremon tibialis (*Lawr.*)
*157. Arremon aurantiirostris *Lafr.*
*158. Saltator atriceps *Less.*
*159. Saltator magnoides *Lafr.*
*160. Saltator grandis (*Licht.*)
*161. Pitylus poliogaster *Du Bus.*
*162. Pitylus grossus (*Linn.*)

Family FRINGILLIDÆ.

*163. Pheucticus tibialis *Baird.*
*164. Habia ludoviciana (*Linn.*)
165. Oryzoborus funereus *Scl.*
*166. Guiraca cærulea (*Linn.*)
*167. Guiraca cyanoides (*Lafr.*)
*168. Sporophila morelleti (*Puch.*)

*169. Sporophila corvina (*Scl.*)
*170. Sporophila amita (*Bonap.*)
*171. Volatinia jacarina (*Linn.*)
*172. Phonipara pusilla (*Sw.*)
*173. Passerina cyanea (*Linn.*)
*174. Passerina ciris (*Linn.*)
*175. Amaurospiza concolor *Cab.*
*176. Junco vulcani (*Boucard*).
*177. Zonotrichia pileata (*Bodd.*)
*178. Coturniculus savannarum (*Gm.*)
*179. Spiza americana (*Gm.*)
*180. Embernagra striaticeps *Lafr.*
*181. Embernagra superciliosa *Salv.*
*182. Pyrgisoma cabanisi *Scl. & Salv.*
*183. Pyrgisoma leucotis (*Cab.*)
184. Hæmophila ruficauda (*Bonap.*)
*185. Astragalinus mexicana (*Sw.*)
*186. Astragalinus columbiana (*Lafr.*)
*187. Astragalinus xanthogastra (*DuBus*).
*188. Acanthidops bairdi *Ridgway.*

Family ICTERIDÆ.

*189. Ocyalus wagleri (*Gray & Mitch.*)
*190. Ostinops montezumæ (*Less.*)
*191. Amblycercus prevosti (*Less.*)
*192. Cassicus microrhynchus *Scl. & Salv.*
*193. Icterus pectoralis espinachi *Nutting.*
*194. Icterus prosthemelas *Strickl.*
*195. Icterus mesomelas *Wagl.*
196. Icterus giraudi *Cass.*
*197. Icterus spurius (*Linn.*)
*198. Icterus galbula (*Linn.*)
*199. Molothrus æneus (*Wagl.*)
200. Agelaius phœniceus (*Linn.*)
201. Dolichonyx oryzivorus (*Linn.*)
202. Quiscalus macrurus *Sw.*
203. Cassidix oryzivora (*Linn.*)
*204. Sturnella magna mexicana *Lawr.*

Family CORVIDÆ.

*205. Psilorhinus mexicanus *Rüpp.*
*206. Cyanocorax affinis *Pelz.*
*207. Cyanocorax argentigula (*Lawr.*)
*208. Cyanocorax cucullatus *Ridgway.*
*209. Calocitta formosa (*Sw.*)

Family ALAUDIDÆ.

210. Otocoris alpestris chrysolæma (*Wagl.*)

(CLAMATORES.)

Family DENDROCOLAPTIDÆ.

*211. Synallaxis erythrops *Scl.*
*212. Synallaxis pudica *Scl.*
213. Synallaxis rufigenis *Lawr.*
214. Synallaxis erythrothorax *Scl.*
*215. Philydor rufobrunneus *Lawr.*
*216. Philydor rufus panerythrus (*Scl.*)
*217. Philydor virgatus *Lawr.*
*218. Automolus cervinigularis *Scl.*
*219. Anabazenops variegaticeps *Scl.*
*220. Anabazenops subalaris lineatus (*Lawr.*)
*221. Xenops genibarbis *Ill.*
222. Xenops rutilus *Licht.*
*223. Sittasomus sylvioides *Lafr.*
*224. Margarornis rubiginosa *Lawr.*
*225. Margarornis brunnescens *Scl.*
*226. Glyphorhynchus cuneatus (*Licht.*)
*227. Dendrocolaptes sancti-thomæ (*Lafr.*)
*228. Dendrocolaptes puncticollis *Scl. & Salv.*
*229. Dendrornis pardalotus (*Vieill.*)
*230. Dendrornis erythropygia *Scl.*
*231. Dendrornis lachrymosa *Lawr.*
*232. Dendrornis susurrans (*Jard.*)
*233. Picolaptes affinis (*Lafr.*)
*234. Picolaptes compressus (*Cab.*)
*235. Pseudocolaptes lawrencii *Ridgway.*
236. Dendrocincla anabatina *Scl.*
*237. Dendrocincla homochroa *Scl.*
*238. Dendrocincla atrirostris (*Lafr.*)
*239. Xiphorhynchus pusillus *Scl.*
240. Sclerurus mexicanus *Scl.*
*241. Sclerurus guatemalensis *Hartl.*

Family OXYRHAMPHIDÆ.

*242. Oxyrhamphus frater *Scl. & Salv.*

Family FORMICARIIDÆ.

*243. Cymbilanius lineatus fasciatus *Ridg.*
*244. Thamnophilus doliatus (*Linn.*)
245. Thamnophilus punctatus *Cab.*
*246. Thamnophilus nævius (*Gm.*)
*247. Thamnophilus bridgesi *Scl.*
*248. Thamnophilus transandeanus *Scl.*
*249. Thamnophilus immaculatus *Lafr.*
*250. Thamnistes anabatinus *Scl. & Salv.*
*251. Dysithamnus semicinereus *Scl.*
*252. Dysithamnus striaticeps *Lawr.*
*253. Dysithamnus puncticeps *Salv.*
*254. Myrmotherula fulviventris *Lawr.*
*255. Myrmotherula melæna *Scl.*
*256. Myrmotherula menetriesi *D'Orb.*
*257. Formicivora boucardii *Scl.*
*258. Ramphocænus semitorquatus *Lawr.*
*259. Ramphocænus rufiventris *Bp.*
*260. Gymnocichla chiroleuca *Scl. & Salv.*
*261. Cercomacra tyrannina *Scl.*
*262. Myrmeciza immaculata *Scl. & Salv.*
*263. Myrmeciza læmosticta *Salv.*
*264. Hypocnemis nævoides (*Lafr.*)
*265. Pithys bicolor *Lawr.*
*266. Phlogopsis macleannani *Lawr.*
267. Formicarius analis (*Lafr. & D'Orb.*)
*268. Formicarius hoffmanni *Cab.*
*269. Pittasoma michleri zeledoni *Ridg.*
*270. Grallaria intermedia *Ridgway.*
*271. Grallaria dives *Salv.*
*272. Grallaria princeps *Scl. & Salv.*
*273. Grallaricula costaricensis *Lawr.*
274. Grallaricula flavirostris *Scl.*

Family TYRANNIDÆ.

*275. Sayornis aquatica *Scl. & Salv.*
*276. Copurus leuconotus *Lafr.*
277. Platyrhynchus cancrominus *Scl.*
*278. Platyrhynchus superciliaris *Lawr.*
*279. Platyrhynchus albigularis *Scl.*
*280. Todirostrum cinereum (*Linn.*)
*281. Todirostrum nigriceps *Scl.*
282. Todirostrum schistaceiceps *Scl.*
*283. Orchilus ecaudatus (*Lafr. & D'Orb.*)
284. Pogonotriccus zeledoni *Lawr.*
*285. Oncostoma cinereigulare *Scl.*
*286. Euscarthmus squamicristatus (*Lafr.*)
*287. Mionectes assimilis *Scl.*
*288. Mionectes olivaceus *Lawr.*
*289. Tyrannulus brunneicapillus *Lawr.*
*290. Tyranniscus villissimus *Scl. & Salv.*
*291. Tyranniscus parvus *Lawr.*
*292. Elainea pagana (*Licht.*)
*293. Elainea placens *Scl.*
*294. Elainea frantzii *Lawr.*
295. Elainea arenarum *Salv.*
*296. Legatus albicollis (*Vieill.*)
*297. Legatus variegatus (*Scl.*)
*298. Myiozetetes texensis (*Girard*).
*299. Myiozetetes granadensis *Lawr.*
*300. Rhyonchocyclus cinereiceps (*Scl.*)
*301. Rhyonchocyclus brevirostris (*Cab.*)
*302. Pitangus derbianus (*Kaup*).
*303. Myiodynastes luteiventris *Bonap.*
*304. Myiodynastes hemichrysus (*Cab.*)
*305. Myiodynastes audax (*Gm.*)
*306. Megarhynchus pitangua (*Linn.*)
*307. Muscivora mexicana *Scl.*
*308. Myiobius sulphureipygius (*Scl.*)
*309. Myiobius erythrurus (*Cab.*)
*310. Myiobius capitalis (*Salv.*)
*311. Myiobius atricaudus (*Lawr.*)
*312. Mitrephanes aurantiiventris *Lawr.*
*313. Empidonax pusillus traillii (*Aud.*)
*314. Empidonax flaviventris *Baird.*
*515. Empidonax flavescens *Lawr.*
316. Empidonax minimus *Baird.*
317. Empidonax acadicus (*Gm.*)
318. Empidonax albigularis *Scl.*
*319. Empidonax atriceps *Salv.*
*320. Empidonax viridescens *Ridgway.*
*321. Contopus virens (*Linn.*)
*322. Contopus borealis (*Sw.*)
*323. Contopus richardsoni (*Sw.*)
*324. Contopus lugubris *Lawr.*
325. Contopus ochraceous *Scl. & Salv.*
326. Contopus brachytarsus *Scl.*
*327. Myiarchus crinitus (*Linn.*)
*328. Myiarchus lawrencii nigricapillus (*Cab.*)
329. Myiarchus tyrannulus (*Müll.*)

*330. Myiarchus nuttingi *Ridgway.*
*331. Tyrannus melancholicus satrapa (*Licht.*)
332. Tyrannus tyrannus (*Linn.*)
333. Tyrannus dominicensis (*Gm.*)
*334. Tyrannus vociferans *Sw.*
*335. Milvulus tyrannus (*Linn.*)
*336. Milvulus forficatus (*Gm.*)
*337. Serpophaga grisea *Lawr.*
338. Leptopogon superciliaris *Tsch.*
339. Leptopogon pileatus *Cab.*
340. Pyrocephalus mexicanus *Scl.*

Family COTINGIDÆ.

*341. Tityra personata *Jard. & Selby.*
*342. Tityra fraseri *Kaup.*
*343. Hadrostomus aglaiæ (*Lafr.*)
*344. Pachyrhamphus cinereiventris *Scl.*
*345. Pachyrhamphus cinnamomeus *Lawr.*
346. Pachyrhamphus versicolor (*Hartl.*)
347. Pachyrhamphus albo-griseus *Scl.*
*348. Lathria unirufa (*Scl.*)
*349. Aulia rufescens (*Scl.*)
*350. Lipaugus holerythrus *Scl.*
*351. Attila sclateri *Lawr.*
*352. Heteropelma veræpacis *Scl.*
*353. Piprites griseiceps *Salv.*
*354. Pipra mentalis *Scl.*
*355. Pipra velutina *Berlepsch.*
*356. Pipra leucorrhoa *Scl.*
*357. Chiroxiphia linearis (*Bonap.*)
*358. Chiromachæris candei (*Parzud.*)
*359. Chiromachæris aurantiaca *Salv.*
*360. Cotinga amabilis *Gould.*
*361. Querula cruenta (*Bodd.*)
362. Carpodectes nitidus *Salv.*
*363. Carpodectes antoniæ *Zeledon.*
*364. Chasmorhynchus tricarunculatus *Verr.*
*365. Cephalopterus glabricollis *Gould.*

ORDER STRISORES.

Family MOMOTIDÆ.

*366. Urospatha martii (*Spix*).
*367. Momotus lessoni *Less.*
*368. Prionirhynchus platyrhynchus (*Leadb*).
369. Prionirhynchus carinatus (*Du Bus*).
*370. Eumomota superciliaris (*Jard. & Selby.*)

Family ALCEDINIDÆ.

371. Ceryle torquata (*Linn.*)
*372. Ceryle amazona (*Lath.*)
373. Ceryle alcyon (*Linn.*)
*374. Ceryle cabanisi (*Tsch.*)
*375. Ceryle superciliosa (*Linn.*)
*376. Ceryle inda (*Linn.*)

Family GALBULIDÆ.

*377. Galbula melanogenia *Scl.*
*378. Jacamerops grandis (*Gm.*)

Family BUCCONIDÆ.

*379. Malacoptila panamensis *Lafr.*
*380. Monasa grandior *Scl. & Salv.*
381. Bucco dysoni *Scl.*

Family TROGONIDÆ.

*382. Trogon puella *Gould.*
*383. Trogon caligatus *Gould.*
*384. Trogon aurantiiventris *Gould.*
*385. Trogon clathratus *Salv.*
*386. Trogon bairdii *Lawr.*
*387. Trogon atricollis *Vieill.*
*388. Trogon massena *Gould.*
*389. Trogon melanocephalus *Gould.*
*390. Pharomacrus costaricensis *Cab.*

Family CAPRIMULGIDÆ.

*391. Chordeiles acutipennis texensis (*Lawr.*)
*392. Antrostomus carolinensis (*Gm.*)

*393. Nyctidromus albicollis (*Gm.*)
*394. Stenopsis albicauda *Lawr.*
*395. Nyctibius jamaicensis (*Gm.*)

Family CYPSELIDÆ.

*396. Hemiprocne zonaris (*Shaw*).
*397. Chætura rutila (*Vieill.*)
*398. Chætura gaumeri *Lawr.*

Family TROCHILIDÆ.

399. Eutoxeres aquila (*Bourc.*)
*400. Glaucis hirsuta (*Gm.*)
*401. Glaucis ruckeri (*Bourc.*)
*402. Phæthornis emiliæ (*Bourc.*)
*403. Phæthornis longirostris (*Less.*)
*404. Phæthornis adolphi *Gould.*
*405. Campylopterus hemileucurus (*Licht.*)
406. Campylopterus cuvieri (*Delattre*).
407. Cœligena hemileuca (*Salv.*)
*408. Oreopyra calolæma *Salv.*
*409. Oreopyra leucaspis *Gould.*
410. Oreopyra cinereicauda *Lawr.*
411. Lampornis prevosti (*Less.*)
412. Lampornis veraguensis *Gould.*
*413. Chalybura isauræ (*Gould.*)
*414. Chalybura melanorrhoa *Salv.*
415. Florisuga mellivora (*Linn.*)
*416. Petasophora cyanotis (*Bourc.*)
417. Petasophora delphinæ (*Less.*)
*418. Eugenes spectabilis *Lawr.*
*419. Heliodoxa jacula *Gould.*
*420. Hemistephania veraguensis (*Salv.*)
*421. Floricola longirostris *Vieill.*
422. Floricola constanti (*Delattre*).
*423. Thalurania columbica (*Bourc. & Muls.*)
424. Microchera albocoronata (*Lawr.*)
*425. Microchera parvirostris *Lawr.*
*426. Trochilus colubris *Linn.*
427. Selasphorus flammula *Salv.*
*428. Selasphorus scintilla *Gould.*
*429. Selasphorus ardens *Salv.*
*430. Selasphorus torridus *Salv.*
*431. Doricha bryanti *Lawr.*
*432. Lophornis helenæ (*Delattre*).
*433. Gouldia conversi (*Bourc. & Muls.*)
*434. Chrysuronia eliciæ (*Bourc. & Muls.*)
*435. Heliothrix barroti (*Bourc.*)
*436. Abeillia typica (*Bon.*)
*437. Klais guimeti (*Bourc. & Muls.*)
*438. Panterpe insignis *Cab.*
439. Agyrtria candida (*Bourc. & Muls.*)
440. Arinia boucardi *Muls.*
*441. Elvira cupreiceps (*Lawr.*)
*442. Elvira chionura (*Gould*).
*443. Callipharus nigriventris (*Lawr.*)
*444. Eupherusa egregia *Scl. & Salv.*
445. Amazilia cinnamomea (*Less.*)
*446. Amazilia fuscicaudata (*Fras.*)
447. Amazilia eduardi (*Delattre*).
*448. Amazilia sophiæ (*Bourc. & Muls.*)
*449. Amazilia niveiventris (*Gould*).
450. Juliamyia typica *Bonap.*
*451. Damophila amabilis (*Gould*).
452. Cyanophaia cæruleigularis (*Gould*).
*453. Chlorostilbon salvini (*Cab.*)
454. Chlorostilbon angustipennis (*Fras.*)

ORDER ZYGODACTYLI.

Family CUCULIDÆ.

*455. Crotophaga sulcirostris *Sw.*
456. Dromococcyx phasianellus (*Spix*).
*457. Diplopterus nævius (*Linn.*)
*458. Piaya cayana mehleri (*Bonap.*)
*459. Morococcyx erythropygia (*Less.*)
460. Coccygus americanus (*Linn.*)
461. Coccygus erythropthalmus (*Wils.*)
*462. Coccygus minor (*Gm.*)
463. Coccygus ferrugineus *Gould.*
464. Neomorphus salvini *Scl.*

Family RAMPHASTIDÆ.

*465. Ramphastus tocard *Vieill.*
*466. Ramphastus carinatus *Sw.*
*467. Pteroglossus torquatus (*Gm.*)
*468. Pteroglossus frantzii *Cab.*

*469. Selenidera spectabilis *Cass.*

*470. Aulacorhamphus cæruleigularis *Gould.*

Family CAPITONIDÆ.

*471. Capito bourcieri (*Lafr.*)

*472. Tetragonops frantzii *Scl.*

Family PICIDÆ.

*473. Campephilus guatemalensis (*Hartl.*)

*474. Ceophlœus scapularis *Vigors.*

*475. Dendrocopus jardinii (*Mahl.*)

*476. Celeus castaneus (*Wagl.*)

*477. Celeus loricatus *Reich.*

*478. Chloronerpes oleagineus (*Licht.*)

*479. Chloronerpes yucatanensis (*Cabot*).

*480. Chloronerpes caboti (*Mahl.*)

*481. Chloronerpes simplex *Salv.*

*482. Melanerpes formicivorus *Sw.*

*483. Melanerpes pucherani (*Mahl.*)

*484. Centurus aurifrons hoffmanni (*Cab.*)

485. Picumnus olivaceus *Lafr.*

Family PSITTACIDÆ.

*486. Ara macao (*Linn.*)

*487. Ara militaris (*Linn.*)

*488. Brotogerys tovi (*Gm.*)

*489. Conurus petzii (*Seibl.*)

*490. Conurus hoffmanni *Cab.*

*491. Conurus finschi *Salv.*

492. Conurus aztec *Souancé.*

*493. Chrysotis albifrons (*Sparm.*)

*494. Chrysotis diademata (*Spix*).

*495. Chrysotis auripalliata (*Less.*)

*496. Chrysotis guatemalæ *Hartl.*

*497. Pionus senilis (*Spix*).

*498. Pionus menstruus (*Linn.*)

*499. Caica hæmatotis *Scl. & Salv.*

500. Myiopsitta lineola (*Cass.*)

ORDER ACCIPITRES.

Family ALUCONIDÆ.

*501. Aluco pratincolus guatemalæ *Ridgway.*

Family STRIGIDÆ.

*502. Strix virgata *Cass.*

*503. Strix nigrolineata *Scl.*

*504. Pulsatrix torquata (*Daud.*)

*505. Bubo virginianus (*Gm.*)

*506. Bubo mexicanus (*Gm.*)

*507. Asio accipitrinus (*Pall.*)

*508. Megascops brasilianus (*Gm.*)

*509. Megascops nudipes (*Vieill.*)

*510. Megascops cooperi (*Ridgway*).

*511. Lophostrix stricklandi *Scl. & Salv.*

512. Speotyto cunicularia hypogæa (*Bp.*)

*513. Glaucidium phalænoides (*Daud.*)

514. Glaucidium pumilum (*Temm.*)

*515. Glaucidium jardini (*Bonap.*)

Family FALCONIDÆ.

516. Falco peregrinus anatum (*Bp.*)

*517. Falco aurantius *Gm.*

*518. Falco albigularis *Daud.*

*519. Falco columbarius *Linn.*

520. Falco fusco-cærulescens (*Vieill.*)

*521. Falco sparverius *Linn.*

*522. Polyborus cheriway (*Jacq.*)

523. Milvago chimachima (*Vieill.*)

*524. Ibycter americanus (*Bodd.*)

*525. Micrastur melanoleucus (*Vieill.*)

*526. Micrastur guerilla *Cass.*

*527. Micrastur mirandolli (*Schleg.*)

*528. Herpetotheres cachinnans (*Linn.*)

529. Pandion haliaetus carolinensis (*Gm.*)

*530. Leptodon cayennensis (*Gm.*)

*531. Regerhinus uncinatus (*Temm.*)

*532. Elanoides forficatus (*Linn.*)

533. Elanus leucurus (*Vieill.*)

*534. Circus hudsonius (*Linn.*)

535. Rostrhamus sociabilis (*Vieill.*)

*536. Ictinia plumbea (*Gm.*)

*537. Harpagus fasciatus *Lawr.*

*538. Accipiter cooperi (*Bonap.*)

*539. Accipiter bicolor (*Vieill.*)

*540. Accipiter fuscus (*Gm.*)

*541. Spiziastur melanoleucus (*Vieill.*)
*542. Spizaetus ornatus (*Daud.*)
*543. Spizaetus tyrannus (*Max.*)
*544. Thrasaetus harpyia (*Linn.*)
545. Urubitornis solitarius (*Tschudi*).
*546. Urubitinga anthracina (*Nitzsch*).
*547. Urubitinga zonura ridgwayi (*Gurney*).
*548. Leucopternis princeps *Scl.*
549. Leucopternis ghiesbreghti (*Du Bus*).
*550. Leucopternis semiplumbeus *Lawr.*
*551. Asturina plagiata (*Licht.*)
*552. Rupornis magnirostris ruficauda (*Scl. & Salv.*)
553. Heterospizias meridionalis (*Lath.*)
*554. Parabuteo unicinctus harrisi (*Aud.*)
*555. Buteo borealis costaricensis *Ridgway.*
*556. Buteo swainsoni *Bonap.*
*557. Buteo albicaudatus *Vieill.*
*558. Buteo pennsylvanicus (*Wils.*)
*559. Buteo fuliginosus *Scl.*
*560. Buteo abbreviatus *Cass.*
*561. Busarellus nigricollis (*Lath.*)
*562. Geranospizias cærulescens nigra (*Du Bus*).

Family CATHARTIDÆ.

563. Gyparchus papa (*Linn.*)
564. Catharista atrata (*Bart.*)
565. Cathartes aura (*Linn.*)

ORDER COLUMBÆ.

Family COLUMBIDÆ.

*566. Columba flavirostris *Wagl.*
*567. Columba albilinea *Gray.*
*568. Columba nigrirostris *Scl.*
*569. Columba subvinacea (*Lawr.*)
570. Columba speciosa *Gm.*
*571. Columba rufina, *Temm.*
*572. Geotrygon montana (*Linn.*)
*573. Geotrygon costaricensis *Lawr.*
*574. Geotrygon chiriquensis *Scl.*
*575. Geotrygon rufiventris *Lawr.*
*576. Geotrygon albiventer *Lawr.*
*577. Engyptila verreauxi (*Bonap.*)
*578. Engyptila cassini (*Lawr.*)
*579. Engyptila rufinucha (*Scl. & Salv.*)
*580. Peristera mondetura *Bonap.*
*581. Peristera cinerea (*Temm.*)
*582. Columbigallina passerina (*Linn.*)
*583. Columbigallina rufipennis (*Bonap.*)
*584. Melopelia leucoptera (*Linn.*)
*585. Zenaidura carolinensis (*Linn.*)

Family CRACIDÆ.

*586. Penelope cristata (*Linn.*)
*587. Chamæpetes unicolor *Salv.*
*588. Ortalis cinereiceps (*Gray*).
*589. Crax globicera *Linn.*

Family PERDICIDÆ.

*590. Ortyx leylandi *Moore.*
*591. Dendrortyx leucophrys *Gould.*
*592. Odontophorus guttatus *Gould.*
*593. Odontophorus veraguensis *Gould.*
*594. Odontophorus leucolæmus *Salv.*
595. Odontophorus melanotis *Salv.*

Family TINAMIDÆ.

*596. Tinamus robustus *Scl. & Salv.*
*597. Nothocercus bonapartii (*Gray*).
598. Crypturus boucardi (*Sallé.*)
*599. Crypturus peliatus (*Bodd.*)
600. Crypturus sallæi (*Bonap.*)

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ORDER LIMICOLÆ.

Family CHARADRIIDÆ.

601. Charadrius dominicus *Müll.*
602. Charadrius squaterola (*Linn.*)
603. Œdicnemus bistriatus *Wagl.*
604. Hoplopterus cayanus *Lath.*
*605. Oxyechus vociferus (*Linn.*)
606. Ægialitis semipalmata *Bonap.*
607. Ægialitis nivosa (*Cass.*)
608. Ægialitis collaris (*Vieill.*)
609. Ochthodromus wilsonius (*Ord.*)

Family HÆMATOPODIDÆ.

610. Hæmatopus palliatus *Temm.*

Family STREPSILIDÆ.

611. Arenaria interpres (*Linn.*)

Family SCOLAPACIDÆ.

612. Gallinago wilsoni (*Temm.*)
613. Macrorhamphus scolapaceus (*Say*).
*614. Totanus flavipes (*Gm.*)
*615. Totanus melanoleucus (*Gm.*)
*616. Rhyacophilus solitarius (*Wils.*)
*617. Actitis macularia (*Linn.*)
618. Bartramia longicauda (*Bechst.*)
619. Actodromus maculata (*Vieill.*)
620. Actodromus bairdii *Coues.*
621. Actodromus fuscicollis (*Vieill.*)
622. Actodromus minutilla (*Vieill.*)
623. Calidris arenaria (*Linn.*)
624. Ereunetes pusillus (*Linn.*)
625. Micropalama himantopus (*Bonap.*)
626. Symphemia semipalmata (*Gm.*)
627. Tryngites rufescens (*Vieill.*)
628. Limosa hæmastica (*Linn.*)
629. Numenius hudsonicus *Lath.*
630. Numenius borealis (*Forst.*)

Family RECURVIROSTRIDÆ.

631. Himantopus mexicanus (*Müll.*)

ORDER HERODIONES.

Family CICONIIDÆ.

*632. Mycteria americana *Linn.*
633. Tantalus loculator *Linn.*

Family IBIDIDÆ.

634. Guara rubra (*Linn.*)
*635. Guara alba (*Linn.*)
636. Plegadis guarauna (*Linn.*)
*637. Harpiprion cayennensis (*Gm.*)

Family PLATALEIDÆ.

*638. Ajaja ajaja (*Linn.*)

Family CANCROMIDÆ.

*639. Cancroma zeledoni *Ridgway.*

Family ARDEIDÆ.

640. Hydronassa tricolor ruficollis (*Gosse.*)
*641. Garzetta candidissima (*Gm.*)
*642. Herodias egretta (*Gm.*)
*643. Ardea herodias *Linn.*
*644. Butorides virescens (*Linn.*)
*645. Florida cærulea (*Linn.*)
*646. Tigrisoma cabanisi *Heine.*
*647. Tigrisoma salmoni *Scl. & Salv.*
648. Agamia picta *Bonap.*
*649. Botaurus lentiginosus (*Montag.*)
650. Botaurus pinnatus (*Licht.*)
*651. Nycticorax nycticorax nævius (*Bodd.*)
*652. Nyctherodius violaceus (*Linn.*)

Family EURYPYGIDÆ.

*653. Eurypyga major *Hartl.*

ORDER ALECTORIDES.

Family ARAMIDÆ.

*654. Aramus giganteus (*Bonap.*)
*655. Aramides cayennensis (*Gm.*)
656. Ionornis martinica (*Linn.*)
657. Gallinula galeata (*Licht.*)
*658. Fulica americana *Gm.*
*659. Porzana albigularis (*Lawr.*)
*660. Porzana cinereiceps *Lawr.*
*661. Porzana carolina (*Linn.*)

Family JACANIDÆ.

*662. Jacana gymnostoma (*Wagl.*)

Family HELIORNITHIDÆ.

663. Heliornis fulica *Bodd.*

Family ANATIDÆ.

*664. Dendrocygna autumnalis (*Linn.*)
*665. Cairina moschata (*Linn.*)
666. Anas boschas *Linn.*
*667. Querquedula discors (*Linn.*)
*668. Querquedula cyanoptera (*Vieill.*)
*669. Dafila acuta (*Linn.*)
670. Spatula clypeata (*Linn.*)
*671. Fulix affinis (*Eyton*).
672. Mareca americana (*Gm.*)
673. Erismatura rubida (*Wils.*)

ORDER STEGANOPODES.

Family PELECANIDÆ.

674. Pelecanus erythrorhynchus *Gm.*
675. Pelecanus fuscus *Linn.*

Family SULIDÆ.

676. Sula leucogastra (*Bodd.*)

Family FREGATIDÆ.

677. Fregata aquila (*Linn.*)

Family PHALACROCORACIDÆ.

*678. Phalacrocorax brasilianus (*Gm.*)

Family PLOTIDÆ.

679. Plotus anhinga (*Linn.*)

Family PHÆTHONTIDÆ.

680. Phæthon æthereus *Linn.*
681. Phæthon flavirostris *Brandt.*

ORDER LONGIPENNES.

Family LARIDÆ.

682. Larus atricilla *Linn.*
683. Anous stolidus (*Linn.*)
684. Sterna maxima *Bodd.*
685. Sterna nilotica *Hasselq.*
686. Sterna fuliginosa *Gm.*
687. Sterna anosthæta *Scop.*
688. Hydrochelidon surinamensis (*Gm.*)

Family RHYNCHOPSIDÆ.

689. Rhynchops nigra *Linn.*

ORDER TUBINARES.

Family PROCELLARIDÆ.

690. Diomedea ———.

ORDER PYGOPODES.

Family PODICIPIDÆ.

691. Podilymbus podiceps (*Linn.*)
692. Podiceps dominicus (*Linn.*)

Table of families, showing number of genera and species.

Families.	Genera.	Species.	Families.	Genera.	Species.
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Syviidæ	1	1	Cracidæ	4	4
Troglodytidæ	9	21	Perdicidæ	3	6
Mniotiltidæ	14	36	Tinamidæ	3	5
Hirundinidæ	7	8	Charadriidæ	6	9
Vireonidæ	6	12	Hæmatopodidæ	1	1
Ptilogonatidæ	2	2	Strepsilidæ	1	1
Cœrebidæ	5	7	Scolopacidæ	14	19
Tanagridæ	17	55	Recurvirostridæ	1	1
Fringillidæ	18	26	Ciconiidæ	2	2
Icteridæ	11	16	Ibididæ	3	4
Corvidæ	3	5	Plataleidæ	1	1
Alaudidæ	1	1	Cancromidæ	1	1
Dendrocolaptidæ	15	31	Ardeidæ	11	13
Oxyrhamphidæ	1	1	Erypygidæ	1	1
Formicariidæ	17	32	Aramidæ	1	1
Tyrannidæ	29	66	Rallidæ	5	7
Cotingidæ	17	25	Jacanidæ	1	1
Momotidæ	4	5	Heliornithidæ	1	1
Alcedinidæ	1	6	Anatidæ	9	10
Galbulidæ	2	2	Pelecanidæ	1	2
Bucconidæ	3	3	Sulidæ	1	1
Trogonidæ	2	9	Fregatidæ	1	1
Caprimulgidæ	5	5	Phalacrocoracidæ	1	1
Cypselidæ	2	3	Plotidæ	1	1
Trochilidæ	36	56	Phæthontidæ	1	2
Cuculidæ	7	10	Laridæ	4	7
Ramphastidæ	4	6	Rhynchopsidæ	1	1
Capitonidæ	2	2	Procellaridæ	1	1
Picidæ	8	13	Podicipidæ	2	2
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Actodromus	919	Bartramia	618
Ægialitis	606	Basileuterus	71
Agamia	648	Botaurus	649
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Aramus	654	Calidris	623
Ara	486	Calliste	54
Arinia	440	Callipharus	443
Ardea	643	Calocitta	209
Arenaria	611	Campephilus	249
Arremon	157	Campylorhynchus	23
Asio	507	Campylopterus	405
Astragalinus	185	Cancroma	639
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Genera.	Corresponding numbers of first species.
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Certhiola	107
Ceryle	371
Charadrius	601
Chasmorhynchus	364
Chalybura	413
Chamæpetes	587
Chætura	397
Chiromachæris	358
Chiroxiphia	357
Chlorophanes	104
Chlorophonia	108
Chlorothraupis	137
Chlorospingus	148
Chloronerpes	478
Chlorostilbon	453
Chordeiles	391
Chrysuronia	434
Chrysotis	493
Cinclus	20
Cistothorus	42
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Coccygus	460
Cœreba	105
Cœligena	407
Copurus	276
Columba	566
Columbigallina	582
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Coturniculus	178
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Crotophaga	455
Crypturus	598
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Cyphorinus	25
Cymbilanius	243
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Dacnis	102
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Dendrocopus	475
Dendrocygna	664
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Ereunetes	424
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Eugenes	418
Eugyptila	577
Eupherusa	444
Euphonia	109
Eumomota	370
Eurypyga	653
Euscarthmus	286
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Galeoscoptes	19
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Gallinula	657
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Habia	164
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Hæmatopus	610
Hæmophila	184
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Harpiprion	637
Heliodoxa	419
Heliothrix	435
Heliornis	663
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Helmitherus	49
Hemiprocne	396
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Henicorhina	27
Herpetotheres	528
Herodias	642
Heteropelma	352
Heterospizias	553
Himantopus	631
Hirundo	82
Hoplopterus	604
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Hylophilus	95
Hydronassa	640
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Genera.	Corresponding numbers of first species.
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Juliamyia	450
Junco	176
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Klais	437
L.	
Lampornis	411
Lanio	138
Lanivireo	92
Larus	682
Lathria	348
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Leptodon	530
Leptopogon	338
Leucopternis	548
Limosa	628
Lipaugus	350
Lophornis	432
Lophostrix	511
M.	
Macrorhamphus	613
Malacoptila	379
Mareca	672
Margarornis	224
Megarhynchus	306
Megascops	508
Melanerpes	482
Melopelia	584
Micrastur	525
Microcerculus	26
Microchera	424
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Milvulus	335
Mimus	18
Mionectes	287
Mitrephanes	312
Mniotilta	43
Molothrus	199
Momotus	367
Monasa	380
Morococcyx	459
Muscivora	307
Myadestes	17
Myiarchus	327
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Nycticorax	651
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Ochthodromus	609
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Œdicnemus	603
Oporornis	62
Orchilus	283
Oreopyra	408
Oreothlypis	45
Oryzoborus	165
Ortalis	588
Ortyx	590
Oncostoma	285
Ostinops	190
Otocoris	210
Oxyechus	605
Oxyrhamphus	242
P.	
Pachyrhamphus	344
Pandion	529
Panterpe	438
Parabuteo	554
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Pelecanus	674
Penelope	586
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Petasophora	416
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Phæthornis	402
Phæthon	680
Phainoptila	100
Phalacrocorax	678
Pharomacrus	390
Pheucticus	163
Phlogopsis	266
Phlogothraupis	129
Philydor	215
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Pipra	354
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Polyborus	522
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Ramphocelus	128
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Regerhinus	531
Rhodinocichla	22
Rhyacophilus	616
Rhynchops	689
Rhynchocyclus	300
Rosthramus	535
Rupornis	552
S.	
Saltator	158
Sayornis	275
Sclerurus	240
Seiurus	59
Selasphorus	427
Selenidera	469
Serpophaga	337
Setophaga	76
Sittasomus	223
Spatula	670
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Sturnella	204
Sula	676
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Tachyphonus	142
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Tantalus	633
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Thalurania	423
Thamnophilus	244
Thamnistes	250
Thrasaetus	544
Thryophilus	29
Thryothorus	36
Tigrisoma	646
Tinamus	596
Tityra	341
Todirostrum	280
Totanus	614
Tryngites	627
Trochilus	426
Troglodytes	40
Trogon	382
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Tyrannus	331
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Zenaidura	585
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IDENTIFICATION OF THE SPECIES OF CYPRINIDÆ AND CATOSTOMIDÆ, DESCRIBED BY DR. CHARLES GIRARD, IN THE PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA FOR 1856.

By DAVID S. JORDAN.

In the years from 1851 to 1855 large collections of fresh-water fishes were made in the western parts of the United States by naturalists attached to the United States and Mexican Boundary Commission and to the Pacific Railroad Survey.

The new species in these collections were described by Dr. Charles Girard in different papers in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1853 to 1859, and again in the report of the United States and Mexican Boundary Survey and the United States and Pacific Railroad Explorations, Vol. X, both works being issued in 1859.

The *Cyprinidæ* and *Catostomidæ* included in these collections were nearly all described for the first time in a paper entitled "Researches upon the Cyprinoid fishes inhabiting the fresh waters of the United States west of the Mississippi Valley, from specimens in the museum of the Smithsonian Institution." This was published in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1856, pages 154–208.

Girard's descriptions of these difficult fishes are very far from good. The characters noted are usually superficial ones, and real specific distinctions, such as differences in the numbers of the scales of the lateral line, are generally overlooked.

After Dr. Girard's connection with the Smithsonian Institution had closed many of his labels became obliterated; some of his types were lost or destroyed, and a certain identification of many of his species could not be made. A careful examination of the material studied by him, including many bottles from which the labels have been lost, has enabled the writer to positively identify very many of his types not hitherto recognized. There is also a series of many of Girard's types in the possession of the Academy of Philadelphia, these having been presented many years ago by the Smithsonian Institution. These types have been studied by Mr. Seth E. Meek, and many of them by the writer also.

The present paper contains a list of Girard's species, arranged in the order given by him, and opposite each my identification of it. Those species of which the types are still in the National Museum are indicated by a star (*); those which are found at present only in the Academy of Sciences by a dagger (†). A number of synonymic notes are added. A few notes taken from manuscripts of Mr. Meek, and not verified by me, are credited to him.

Name.	Identification.
* Mylocheilus fraterculus	Mylochilus caurinus, (Rich.).
* Mylopharodon conocephalus, (B. & G.)	Mylopharodon conocephalus, (B. & G.).
* Carpiodes damalis	Ictiobus velifer bison, (Ag.).
* Ictiobus tumidus, (B. & G.)	Ictiobus velifer tumidus, (B. & G.).
* Moxostoma claviformis[1]	Erimyzon sucetta oblongus, (Mitch.).
* Moxostoma kennerlii	Erimyzon sucetta, (Lac.).
Moxostoma victoriæ	Minytrema melanops, (Raf.).
Moxostoma campbelli	Erimyzon sucetta, (Lac.).
* Ptychostomus congestus, (B. & G.)	Moxostoma congestum, (B. & G.).

[1] This is the ordinary northern *Erimyzon*, described in Jordan & Gilbert's Synopsis, p. 133, as *Erimyzon sucetta*. The two forms of *Erimyzon* seem to grade into each other. South Carolina examples belong to the southern type, which is, therefore, in all probability, the real *Cyprinus sucetta* of Lacépède. The northern form (*sucetta* of the Synopsis) may stand as *Erimyzon sucetta oblongus*, and the southern form (*E. goodei* of the Synopsis) as *Erimyzon sucetta*. The southern form ranges from South Carolina to Texas, and the type of *M. kennerlii* belongs to it.

Name.	Identification.
* Ptychostomus albidus[1]	Moxostoma congestum, (B. & G.).
Ptychostomus haydeni	? Moxostoma macrolepidotum, (Le. S.).
* Minomus insignis, (B. & G.) [2]	Catostomus insignis, (B. & G.).
* Minomus plebeius, (B. & G.) [3]	Pantosteus plebius, (B & G.).
* Minomus clarki, (B. & G.)[4]	Catostomus clarki, (B. & G.).
* Acomus latipinnis, (B. & G.)	Catostomus latipinnis, (B. & G.).
* Acomus guzmaniensis[5]	Pantosteus guzmaniensis, (Grd.).
Acomus generosus[6]	Pantosteus generosus, (Grd.).
* Acomus griseus	Catostomus catostomus, (Forster).
Acomus lactarius	Catostomus catostomus, (Forster).
* Catostomus macrocheilus	Catostomus macrocheilus, (Grd.).
Catostomus sucklii	Catostomus teres, (Mitch.).
* Catostomus bernardini[7]	Catostomus bernardini, (Grd.).
* Campostoma ornatum[8]	Campostoma ornatum, (Grd.).
* Campostoma formosulum[9]	Campostoma formosulum, (Grd.).
* Campostoma nasutum[10]	Campostoma anomalum, (Raf.).

[1] The type of *Ptychostomus albidus* is a young individual of *M. congestum*. The scales are of the usual size in this genus, about 45 in the lateral line instead of 56 as shown in Girard's figure. *Moxostoma congestum* is very common in Texas, and seems to be quite distinct from *M. macrolepidotum*.

[2] *Catostomus insignis* is a valid species, nearer *C. teres* than *C. clarki*, but having a broader upper lip than the former. Its scales are considerably crowded anteriorly, much more so than in *C. clarki*, though less so than in *C. teres*; about 27 scales before dorsal. Lat. l. 56. D. 10. Lips broad, the upper with many series of tubercles; lower without cartilaginous sheath; fontanelle small. This is the *Catostomus insigne* of Cope & Yarrow.

[3] The type of *Catostomus plebeius* is a *Pantosteus*, allied to *P. generosus*, but with the scales before the dorsal larger. Scales crowded forwards; upper lip full, with 2 or 3 rows of tubercles; lower with 5. Jaws with cartilaginous sheaths. Snout broad, moderately projecting. Fins much lower than in *P. guzmaniensis*. D. 9. Lat. l. 90; 29 to 30 in cross series. Head $4\frac{3}{5}$ in length; depth 5. Ventral fins rather short. I do not see that the descriptions of *Pantosteus delphinus* and *P. bardus* indicate any differences from *P. plebeius*.

[4] *Catostomus clarki* is very close to *C. arœopus*, differing chiefly in the larger size of the scales before the dorsal (23 in *clarki*; 42 in *arœopus*). Scales little crowded anteriorly. D. 11. Lat. l. 70.

[5] The type of *Catostomus guzmaniensis* is a *Pantosteus*, and on comparison I am unable to distinguish it from the type of *Pantosteus virescens*, Cope. The latter is said to be from Pueblo, Colo. The specimens of the former are much smaller than the type of the latter, but they are apparently adult, the fins being tuberculate. D. 10. Lat. l. nearly 100; 46 scales before dorsal. Lips with cartilaginous sheath; upper lip with many rows of tubercles. Eye small; fins high, the longest ray of dorsal $1\frac{1}{5}$ in head. Head $4\frac{1}{5}$ in length. No fontanelle.

[6] The type of *Catostomus generosus* seems to me unquestionably identical with the type of *Pantosteus platyrhynchus*, Cope, as well as with *P. jarrovii*, Cope. The peculiarities of *P. platyrhynchus* seem to be due to its shriveled condition.

[7] *Catostomus bernardini* is close to *C. occidentalis*, but the head in the former is less conic and the lower fins longer. Scales much crowded forwards, 75 in the lateral line, 31 before dorsal. D. 12; longer than high. Lips broad, without cartilaginous sheath; the lower, as in *C. occidentalis*, deeply incised. Fontanelle large. Caudal lobes equal.

[8] Lat. l. 73, in type of *Campostoma ornatum*.

[9] Lat. l. 46, in type of *C. formosulum*.

[10] *Campostoma nasutum* is an ordinary *C. anomalum*.

Name.	Identification.
* Dionda episcopa[1]	Dionda episcopa, (Grd.).
* Dionda serena[2]	Dionda serena, (Grd.).
* Dionda texensis[3]	Dionda episcopa, (Grd.).
Dionda papalis	? Dionda serena, (Grd.).
* Dionda argentosa[4]	Dionda episcopa, (Grd.).
† Dionda chrysitis[5]	Dionda serena, (Grd.).
† Dionda melanops[6]	Dionda melanops, (Grd.).
* Dionda couchi	? Dionda melanops, (Grd.).
Dionda plumbea	? Zophendum ? plumbeum, (Grd.).
Dionda spadicea	? Zophendum ? plumbeum, (Grd.).
Dionda grisea, (U. S. Pac. R. R.)	? Zophendum ? plumbeum, (Grd.).
* Hyborhynchus perspicuus	Pimephales notatus, (Raf.).
* Hyborhynchus tenellus	Pimephales notatus, (Raf.).
Hyborhynchus puniceus	? Zophendum ? plumbeum, (Grd.).
* Hyborhynchus confertus	Pimephales promelas confertus, (Grd.).
* Pimephales maculosus	Pimephales promelas confertus, (Grd.).
Pimephales fasciatus	Pimephales promelas, (Raf.).
* Algoma amara	Dionda amara, (Grd.).
Algoma fluviatilis	Dionda fluviatilis, (Grd.).
* Cochlognathus ornatus, (B. & G.)	Cochlognathus ornatus, (B. & G.).
* Hybognathus argyritis	Hybognathus argyritis, (Grd.).
Hybognathus evansi	? Hybognathus nuchalis, (Agass.).
* Hybognathus placitus	Hybognathus nuchalis placita, (Grd.).
* Alganse a bicolor	Algansea bicolor, (Grd.).
* Algansea obesa	Algansea obesa, (Grd.).
* Algansea formosa[7]	Algansea symmetrica, (B. & G.).
* Lavinia exilicauda, (B. & G.)	Lavinia exilicauda, (B. & G.).
* Lavinia harengus	Lavinia exilicauda, (B. & G.).
* Argyreus dulcis	Rhinichthys cataractæ dulcis, (Grd.).
* Argyreus nubilus[8]	Agosia nubila, (Grd.).

[1] This species has been lately fairly described by Professor Cope, under the name of *Hybognathus flavipinnis*. The suborbital bones in this and other species of "*Dionda*" are rather broad, much as in *Hybognathus nuchalis*. Lat. l. 37.

[2] This species has been described under the name of *Hybognathus nigrotæniatus* Cope. It has larger scales than *D. episcopa*, and rather smaller eye. Lat. l. 34.

[3] This species seems to be identical with *D. episcopa*. Lat. l. 36 to 39.

[4] This species seems to be also identical with *D. episcopa*. Lat. l. 37.

[5] The types of *Dionda serena* and *D. chrysitis* much resemble each other, except that *D. serena* is much darker in color. *D. chrysitis* has scales 5–32–4. Head 4⅝ in length; depth 4½. Eye 3⅕ in head. Head shorter and body less deep than shown in Girard's figure. (MEEK.)

[6] *D. melanops* and *D. couchi* are little different. The former has scales 7–38–4; the latter 6–36–3. Both are deeper than the other *Diondæ*; depth 3½ to 3¾ in length. In *D. couchi* the lower jaw has a conspicuous dermal fold. This is little developed in *D. melanops* and obsolete in the other *Diondæ*. The black caudal spot is much more distinct in *D. melanops* than in *D. couchi*. (MEEK.)

[7] The original type of *Pogonichthys symmetricus*, B. & G., has no barbel, and the teeth are 4–5. Lat. l. 53. Depth 4⅓ in length. It seems to be identical with *Algansea formosa*. The name *Algansea* should apparently supersede *Leucos* (preoccupied) and *Myloleucus*. *Algansea antica*, Cope (type examined by me) seems to be a valid species of this genus. The following notes may be added to Cope's description:

Head 3⅗ in length; depth 3⅗. Head acute, subconic; snout rather pointed, 4⅔ in head. Insertion of dorsal midway between pupil and base of caudal. Mouth small; jaws equal; maxillary 4 in head. Pectoral short, not nearly reaching ventral. Lateral line decurved. Scales 10–49–6. Teeth 4–5, little hooked, with very broad grinding surface.

[8] I am unable to separate *Apocope vulnerata*, *henshavii*, *rhinichthyoides*, or *couesi* from *A. nubila*. *A. oscula*, Cope (not Grd.), is also the same, as is probably *Apocope carringtoni* also. The genus *Apocope* may apparently, without violence, be united to *Agosia*.

Name.	Identification.
* Argyreus osculus[1]	Agosia oscula, (Grd.).
Argyreus notabilis	Agosia oscula, (Grd.).
Agosia chrysogaster	Agosia chrysogaster, (Grd.).
Agosia metallica	Agosia metallica, (Grd.).
* Pogonichthys inæquilobus, (B. & G.)	Pogonichthys macrolepidotus, (Ayres).
* Pogonichthys symmetricus, (B. & G.)	Algansea symmetrica, (Grd.).
* Pognichthys argyreiosus, (B. & G.)[2]	Pogonichthys macrolepidotus, (Ayres).
* Pogonichthys communis	Platygobio gracilis, (Rich.).
* Gobio gelidus	Hybopsis gelidus, (Grd.).
* Gobio æstivalis[3]	Hybopsis æstivalis, (Grd.).
Gobio vernalis	Hybopsis amblops, (Raf.).
* Leucosomus dissimilis[4]	Couesius dissimilis, (Grd.).
* Leucosomus pallidus	Semotilus atromaculatus, (Mitch.).
* Leucosomus incrassatus	Semotilus atromaculatus, (Mitch.).
* Nocomis nebracensis	Hybopsis biguttatus, (Kirt.).
Exoglossum mirabile[5]	Phenacobius mirabilis, (Grd.).
Meda fulgida[6]	Meda fulgida, (Grd.).
Cliola vigilax, (B. & G.)[7]	Cliola vigilax, (B. & G.).
Cliola velox	Cliola vigilax, (B. & G.).
* Cliola vivax	Cliola vigilax, (B. & G.).
* Alburnus dilectus[8]	Notropis dilectus, (Grd.).
* Alburnus umbratilis[9]	Notropis umbratilis, (Grd.).
† Alburnus amabilis[10]	Notropis amabilis, (Grd.).

[1] The type of *Argyreus osculus* has about 90 scales in the lateral line, and is identical with *Apocope ventricosa*. The type of *A. notabilis* I cannot find, but the figure seems to be intended for *Agosia oscula*.

[2] The type of *Pogonichthys argyriosus* is the young of *P. macrolepidotus*, with the caudal lobe broken off. The genus "*Symmetrurus*," based on this species, is therefore valueless.

[3] *Ceratichthys sterletus*, Cope, seems to be identical with *Gobio æstivalis;* the types have been compared by me.

[4] I now regard *Couesius milneri*, Jor., *Ceratichthys prosthemius*, Cope, and *Gobio plumbeus* as identical. *Couesius dissimilis* has the scales larger than in *C. plumbeus;* lat. l. 60; cross series 22, the lateral line much decurved; the mouth oblique, subterminal, much as in *Semotilus;* head flattish above; barbel small, terminal. Head 4 in length: depth 4; eye 4¼ in head.

[5] *Exoglossum mirabile*, Grd. = *Sarcidium scopiferum*, Cope = *Phenacobius teretulus* var. *liosternus*, Nelson.

[6] In the types of *Meda fulgida*, the teeth are 2, 4 or 5–5, 1 or 2. The genus is precisely identical with *Plagopterus*, Cope. *Meda fulgida* and *Meda argentissima* are, however, apparently distinct species, although closely related.

[7] *Cliola vigilax*, B. and G. = *Cliola velox*, Grd. = *Cliola vivax*, Grd. = *Hybopsis tuditanus*, Cope = *Alburnops taurocephalus*, Hay = *Hypargyrus tuditanus*, Forbes.

[8] *Alburnus dilectus*, Grd. = *Alburnus oligaspis*, Cope. The types of the latter, examined by me, have 11 anal rays.

[9] *Alburnus umbratilis*, Grd. = *Luxilus lucidus*, Grd = *Notropis nigripinnis*, Gilbert. The type of this species has 44 scales in the lateral line. *Notropis macrolepidotus*, Forbes, much resembles the young of this species, but is said to have rather larger scales. (6–40–3 instead of 9 or 10–44 or 45–4.)

[10] *Notropis amabilis* seems to be a valid species. The following additions may be made to the description as given in the Synopsis. Head less acute than in *N. rubrifrons*. Jaws equal; maxillary reaching front of eye; fins short; dusky blotch at base of caudal very faint. Head 4⅛ in length; depth 5. A. i. 8. Scales 5–34–3.

Name.	Identification.
† Alburnus megalops[1]	Notropis swaini, (Jor. & Gilb.).
* Alburnus socius[2]	Notropis socius, (Grd.).
* Alburnops blennius[3]	Notropis blennius, (Grd.).
Alburnops shumardi	Notropis sp.
* Alburnops illecebrosus[4]	Notropis illecebrosus, (Grd.).
* Codoma ornata	Notropis ornatus, (Grd.).
Codoma vittata	Notropis vittatus, (Grd.).
Plargyrus typicus	Notropis megalops, (Raf.).
Plargyrus bowmani	Notropis megalops, (Raf.).
Cyprinella bubalina, (B. & G.)	Notropis bubalinus, (B. & G.).
* Cyprinelia umbrosa[5]	Notropis bubalinus, (B. & G.).
* Cyprinella gunnisoni[6]	Notropis bubalinus, (B. & G.).
† Cyprinella beckwithi[7]	Notropis bubalinus, (B. & G.).

[1] *Notropis swaini*, Jordan & Gilbert, nom. sp. nov. = *Alburnus megalops*, Grd. The name *megalops* is preoccupied in the genus *Notropis*; we therefore propose for this species the new name *Notropis swaini.* The following description is taken from specimens obtained by Professor Gilbert and the writer in the Rio Comal at New Braunfels, Tex. These have been compared with types of *Alburnus megalops* and *Alburnus socius* in the Philadelphia Academy:

Body moderately elongate, somewhat compressed, a little more robust than in *N. rubrifrons;* back a little elevated. Head rather short and broad, the interorbital space somewhat convex, its width about two-thirds that of the eye. Eye very large, $2\frac{3}{5}$ in head, about half longer than the rather obtuse snout. Mouth large, oblique, the lower jaw slightly projecting; the maxillary reaching nearly to front of pupil; its length $2\frac{4}{5}$ in head. Fins small; dorsal inserted somewhat behind ventrals. Lateral line decurved; scales large, 16 before dorsal.

Head $4\frac{1}{6}$ in length; depth $4\frac{1}{2}$. D. 9. A. 9. Scales 6–35–3. Teeth 2, 4–4, 2, hooked with little, if any, grinding surface.

Color greenish, the scales above dark edged; a plumbeous band along the sides, which does not form a distinct spot at base of caudal; dark dots along lateral line; a dark vertebral streak; fins pale.

This species is common in the outlet to the Comal Spring at New Braunfels. The largest specimens taken are a little over 2 inches in length. Some of these are numbered 36529 in the U. S. National Museum.

[2] A type of *Alburnus socius* in the museum of the Academy belongs to a species apparently different from *N. swaini* (*megalops*). *N. socius* is deeper, the depth being $4\frac{1}{3}$ in length; the head is 4 in body, the eye smaller, 3 in head. The head is rather deep and flattish above; maxillary extending to past front of eye; lower jaw longest. A. 10. Lat. l. 33. Color paler, the sides without dark dots.

[3] In one of the types of *Alburnops blennius* the teeth are 1, 4–4, 0. The snout is a little more convex than in *A. illecebrosus.* The anterior suborbital is in *A. blennius* rather broad, but in *A. illecebrosus* very narrow. Both species are brightly silvery. I am unable to identify *A. shumardi*, the types being lost.

[4] *Alburnops illecebrosus* type. (Phila. Acad.) Head $4\frac{1}{3}$; depth $4\frac{1}{4}$. D. 8. A. 9. Scales 6–36–3. Teeth 2, 4–4, 2, little hooked, with narrow grinding surface, and the edges of the first very slightly crenate. Thirteen scales before dorsal. Eye $3\frac{2}{3}$ in head. Snout rounded, $4\frac{1}{5}$ in head. Mouth oblique; upper lip on level of pupil. Maxillary $3\frac{3}{4}$ in head, reaching front of eye. Color pale, a very bright silvery band along sides, about as wide as eye. (MEEK.)

[5] The types of *Cyprinella umbrosa* have 32 to 35 scales in the lateral line. They are doubtless identical with the prior-named *bubalinus.*

[6] The types of *C. gunnisoni* seem to be the young of *N. bubalinus.* Lat. l. 34.

[7] *Cyprinella beckwithi* seems to be identical with *C. umbrosa*; the differences noticeable seem to be due to the small size of the specimen of *C. beckwithi* examined. Scales 7–34–4. (MEEK.)

Name.	Identification.
† Cyprinella suavis[1]	? Notropis lutrensis.
Cyprinella lepida	Notropis sp.
Cyprinella notata[2]	Notropis notatus, (Grd.).
* Cyprinella whipplei[3]	Notropis whipplei, (Grd.).
* Cyprinella macrostoma[4]	Notropis macrostomus, (Grd.).
† Cyprinella venusta[5]	Notrópis venustus, (Grd.).
* Cyprinella texana[6]	? Notropis notatus, (Grd.).
Cyprinella luxiloides	? Notropis macrostomus, (Grd.).
Cyprinella lugubris	? Notropis macrostomus, (Grd.).
† Cyprinella ludibunda[7]	Notropis ludibundus, (Grd.).
* Moniana lutrensis,[8] (B. & G.)	Notropis lutrensis, (B. & G.).
Moniana leonina	Notropis leoninus, (Grd.).

[1] Two very small specimens of *Cyprinella suavis* are in the museum of the Academy. Head 4¼ in length; depth 3½; eye 4 in head; snout rather pointed; maxillary scarcely reaching eye; 4 in head. Body elliptical, rather deep. D. 8. A. 9. Scales 5-32-3; 15 before dorsal. (MEEK.) This description indicates *Notropis lutrensis.*

[2] The specimens which we suppose to be types of *Cyprinella notata* consist of one *Notropis lutrensis* and two of another species, closely allied to *N. cercostigma*, but with larger scales (lat. l. 34) and faint caudal spot. The latter species may retain the name of *Notropis notatus.*

[3] *Cyprinella whipplei*, Girard, 1856 = *Cyprinella analostana*, Girard, 1859.

[4] *Cyprinella macrostoma* is apparently a valid species. The description in the Synopsis is from the type.

[5] Two types of *Cyprinella venusta* (140 S. I.; Rio Sabinal) are in the museum of the Academy. These have head 4 in length; depth 3⅘; scales 5-31-3; 15 before dorsal. Teeth 4-4. Eye 3⅗ in head; snout 4. D. 7. A. 8. Maxillary reaching front of eye, 3⅘ in head. Mouth very oblique; jaws subequal. Scales larger than in most related species. Brownish above, with a silvery reflection along sides. A round black spot at base of caudal as large as eye.

This species is distinct from *C. texana.* The eye is smaller, the mouth more oblique, and the snout more pointed in *C. venusta* than in *C. texana.* The caudal spot is much more distinct in the former than in the latter. (MEEK.)

From the above description it would appear that this species is distinct from the common *Notropis cercostigma* (= *Luxilus chickasavensis*, Hay = *Cliola urostigma*, Jordan & Meek), with which species I had recently identified Girard's description. *N. stigmaturus,* Jordan = *Cyprinella calliura*, Jordan, is very close to *N. cercostigma*, differing chiefly in the smaller scales (44 instead of 38).

[6] One specimen of *Cyprinella texana* (128 S. I., from Rio Salado) is in the museum of the Academy.

Head 4; depth 3¾. D. 7, A. 8. Scales 5-35-3. Teeth 4-4. Eye 3 in head; snout 3¼; 15 scales before dorsal. Mouth small, little oblique; the snout blunt, projecting. Maxillary 3⅔ in head, not quite reaching front of orbit. Mouth more inferior than is shown in Girard's figure; the snout more blunt. Caudal spot faint. (MEEK.)

This species is perhaps identical with *N. notatus.* It can hardly be the young of *N. cercostigma.*

[7] One specimen of *Cyprinella ludibunda*, 1½ inches long (S. I., 132, from Cottonwood Creek), is in the museum of the Academy.

Head 4; depth 4⅔. Eye 3 in head; snout 4. D. 8, A. 7. Scales 4-31-3; 13 before dorsal. Mouth oblique; maxillary 3⅔ in head, its tip reaching front of eye. First rays of dorsal reaching beyond last when depressed. Scales dusky above.

[8] *Moniana lutrensis*, B. & G. = *Moniana pulchella*, Grd. = *Moniana gracilis*, Grd. = ? *Moniana lætabilis*, Grd. = *Moniana couchi*, Grd. = ? *Cyprinella suavis*, Grd. = *Moniana gibbosa*, Grd. = *Moniana jugalis*, Cope = *Hypsilepis iris*, Cope = *Cyprinella billingsiana*, Cope = *Cyprinella forbesi*, Jor.

Name.	Identification.
* Moniana deliciosa[1]	Notropis deliciosus, (Grd.).
* Moniana proserpina[2]	Notropis proserpina, (Grd.).
* Moniana aurata[3]	Notropis proserpina, (Grd.).
Moniana complanata	Notropis leoninus, (Grd.).
† Moniana lætabilis[4]	Notropis lutrensis, (B. & G.).
* Moniana pulchella[5]	Notropis lutrensis, (B. & G.).
* Moniana frigida[6]	Notropis leoninus, (Grd.).
† Moniana couchi[7]	Notropis lutrensis, (B. & G.).
† Moniana rutila[7]	Notropis lutrensis, (B. & G.).
* Moniana nitida[8]	Notropis nitidus, (Grd.).
† Moniana formosa[9]	Notropis formosus, (Grd.).
* Moniana gracilis[7]	Notropis lutrensis, (B. & G.).

[1] *Moniana deliciosa*, Grd., seems to be identical with *Hybopsis missuriensis*, Cope. *Notropis stramineus*, Cope, seems to be a variety of the same species, with the scales slightly larger, on an average. *Hybopsis longiceps*, Cope, and *H. volucella*, Cope, are but slightly different, and are all probably varieties of *N. deliciosus*.

[2] One of the types of *Moniana proserpina* (117 S. I., Devil's River, Texas) is in the museum of the Academy.

Length 2 inches. Head 3¾; depth 4. D. 7., A. 7. Fourteen scales before dorsal. Scales 6–35–3. Eye 4 in head; snout blunt, 3½ in head; mouth subinferior, nearly horizontal; upper on level of lower edge of orbit. Top of head rather convex, with a slight median crest. Body rather robust; the ventral outline nearly straight; the back elevated. Color brownish above, rather silvery on sides and below, but with no evident silvery lateral band. A blackish metallic band made up of dark punctulations running from upper edge of preopercle to upper edge of base of caudal.

This is identical with the type of *Moniana aurata* (118 S. I., from Piedrapainte, N. Mex.). (MEEK.)

[3] The specimens of *Moniana aurata* are tuberculate males, apparently of the same species as the types of *Moniana proserpina*. Compared with *N. lutrensis*, *N. proserpina* has the mouth smaller and more inferior, the snout and head heavier and more obtuse, and the body rather less deep. The males show a dusky humeral bar, as in *M. lutrensis*, and a faint, dusky, horizontal stripe.

[4] *Moniana lætabilis* (S. I., 120, Hurrah Creek, 1¾ inches long) seems to be indistinguishable from the young of *N. lutrensis*. Head 4 in length; depth 3⅗. Scales 6–35–3; sixteen scales before dorsal. Eye 3½ in head. Mouth very oblique; maxillary reaching front of eye. (MEEK).

[5] *Moniana pulchella*, Grd., is unquestionably identical with *N. lutrensis*. We have compared the types with those of the latter, and with the types of *M. jugalis*, Cope, as well as with numerous specimens collected by Jordan & Gilbert in the streams about Fort Smith.

[6] The types of *Moniana frigida* differ from *N. lutrensis* chiefly in the larger number of scales (37) in the lateral line. The body is also rather more elongate than usual in *N. lutrensis*. I think that *leonina* and *complanata* will be found to be identical with *M. frigida*, but I am unable to find the types of either.

[7] The types of *Moniana couchi*, *rutila*, and *gracilis* are all small fishes, mostly in poor condition. They are indistinguishable from the young of *lutrensis*. (MEEK.) Specimens of *gracilis* are also in the National Museum. They seem a little slenderer than the average *lutrensis*, but probably all belong to that species.

[8] *Moniana nitida* seems to be a valid species allied to *Notropis deliciosus*. A description will be given elsewhere.

[9] *Moniana formosa* (114 S. I., Rio Mimbres) seems to be distinct from all of the other species. Head 3⅘; depth 3½. D. 8. A. 8. Scales 7–43–4; 23 scales before dorsal.

Name.	Identification.
Moniana gibbosa	Notropis lutrensis, (B. & G.).
Moniana tristis	Notropis sp.
* Richardsonius lateralis	Richardsonius lateralis, (Grd.).
* Luxilus occidentalis, (B. & G.)[1]	Luxilinus occidentalis, (B. & G.).
* Luxilus leptosomus [2]	Notemigonus chrysoleucus.
Luxilus seco [3]	Notemigonus ? chrysoleucus.
† Luxilus lucidus [4]	Notropis umbratilis, (Grd.).
* Semotilus macrocephalus	Semotilus atromaculatus, (Mitch.).
* Semotilus speciosus	Semotilus atromaculatus, (Mitch.).
† Tiaroga cobitis [5]	Tiaroga cobitis, (Grd.).
Gila (species)[6]	Gila (species).
Tigoma (species) [6]	Squalius (species).
Cheonda (species)[6]	Squalius (species).

Eye 3½ in head, slightly longer than snout. Snout formed as in *N. lutrensis;* the mouth oblique. Maxillary 3½ in head, reaching past front of orbit. Form fairly represented in Girard's figure, but the caudal peduncle rather more attenuate.

Some blackish dots along the posterior margin of each scale; a dusky band mixed with silvery along sides. A brownish spot as large as pupil on base of caudal. Teeth 4–4.

[1] *Luxilinus*, Jordan; type *Luxilinus occidentalis*, B. & G. This genus is allied to *Notemigonus*, differing in having the belly nowhere carinated, the ventral line behind ventral fins being covered with ordinary imbricated scales. Teeth 5–5, with entire edges and strong grinding surface. Gill-rakers slender, of moderate length. Intestine short, but more elongate than in *Notropis.*

[2] The type of *Luxilus leptosomus* is in bad condition. It is not evidently different from *Notemigonus chrysoleucus.*

[3] The type of *Luxilus seco* (in the Academy at Philadelphia) is a young *Notemigonus* not evidently different from *N. chrysoleucus.* It has A. 13 or 14; lat. l. 55; teeth 5–5 mouth very small; lateral line decurved; a dusky spot at base of caudal.

[4] Two specimens (56 S. I., 3½ inches long) of *Luxilus lucidus*, Girard, are in the museum of the Academy. Head 4; depth 3⅘. D. 8; A. 11. Scales 7–40–3; 25 scales before dorsal. Teeth 2, 4–4, 2, with oblique grinding surface. Ventral line covered with scales. Eye = snout, 3⅗ in head. Insertion of dorsal midway between base of caudal, a point just behind tip of snout. Lateral line decurved. Scales before dorsal much crowded. Mouth oblique, the maxillary reaching front of orbit, 3⅓ in head. Base of anal 1½ in head. (MEEK.)

This species is apparently identical with *Notropis umbratilis*, described from the same region.

[5] A type of *Tiaroga cobitis*, in the Philadelphia Academy, has been examined by me. The genus is evidently a valid one, and very distinct from *Notropis*, approaching most nearly to *Rhinichthys*. The following are my notes on the specimen examined: Body decidedly elongate, loach-like, subfusiform, little compressed, covered with minute scales. Head small, subconical, depressed. Mouth very small, terminal, oblique, without barbels, the maxillary 4 in head, not reaching nearly to eye. Premaxillary not protractile. Lips fleshy. Lower jaw included. Eye moderate, placed high, nearly midway in head, its length 3⅘ in head. Isthmus very wide. Ventrals slightly in advance of dorsal. Fins all high, the first (rudimentary) ray of dorsal somewhat enlarged. Pectorals reaching ventrals; ventrals past front of anal. Head 4⅘ in length: depth 6. D. 8, A. 7. Lat. l. 60 to 70 (not to be counted exactly). Teeth apparently 1, 4–4, 1, extremely small, apparently without grinding surface.

[6] I here omit all reference to the species of *Gila*, "*Tigoma*," and "*Cheonda*," not having yet re-examined Girard's types, and having therefore nothing to add to the account given in the Synopsis.

Name.	Identification.
* Siboma crassicauda, (B. & G.)[1]	Squalius crassicauda, (B. & G.).
Siboma atraria[2]	Squalius atrarius, (Grd.).
* Ptychocheilus rapax[3]	Ptychochilus rapax, (Grd.).
* Ptychocheilus lucius	Ptychochilus lucius, (Grd.).
* Ptychocheilus vorax	Gila grahami, (B. & G.).
Hybognathus regius	Hybognathus nuchalis regia, (Grd.).
* Hudsonius fluviatilis[4]	Notropis hudsonius, (Clinton).
Hudsonius amarus[5]	Notropis hudsonius amarus, (Grd.).
Hybopsis winchelli	Hybopsis amblops, (Raf.).
Clinostomus funduloides	Squalius funduloides, (Grd.).
Clinostomus affinis	Squalius vandoisulus, (C. & V.).
Clinostomus carolinus	? Squalius vandoisulus, (C. & V.).
Alburnus lepidulus	Notropis sp.
Plargyrus argentatus	Notropis megalops, (Raf.).
Ceratichthys leptocephalus	Hybopsis sp.
Nocomis bellicus	Hybopsis biguttatus, (Kirt.).

[1] This is *Leuciscus gibbosus*, Ayres, as stated in the Synopsis, p. 240. The name *Leuciscus gibbosus* is, however, preoccupied by Storer, 1845. The appropriate specific name *crassicauda* should therefore be restored.

[2] It is probable that *Tigoma squamata*, Gill, and *Squalius rhomaleus*, Jordan & Gilbert, are both based on specimens of *Siboma atraria*, Girard.

[3] The only tangible character by which I can separate the type of *Ptychochilus rapax* from the ordinary *Pt. oregonensis* is this: the scales before the dorsal fin in *rapax* are much smaller than in *oregonensis*, there being about 49 scales in the former and 42 in the latter on the median line before the dorsal.

[4] The specimen from Lake Superior described by me (Bull. U. S. Nat. Mus., X., 60, 1877) as *Luxilus selene*, is identical with the types of *Hudsonius fluviatilis*.

[5] The only character by which I can separate *N. amarus* from *N. hudsonius* is the number of the teeth, 1, 4–4, 0, or 1 in *amarus;* 2, 4–4, 1 in *hudsonius*. All specimens examined from Pennsylvania, New York, and the Great Lakes are *hudsonius;* those from Virginia to Georgia seem to be *amarus*. I cannot distinguish from *amarus* either the types of *Alburnops saludanus*, Jordan & Brayton, or those of *Hudsonius euryopa*, Bean *Hybopsis storerianus*, confounded with *N. amarus* by several writers, is a different fish, belonging to another genus (= *Ceratichthys lucens*, Jordan).

INDIANA UNIVERSITY, *April* 23, 1885.

ON THE DEVELOPMENT OF VIVIPAROUS OSSEOUS FISHES.

By **JOHN A. RYDER.**

INTRODUCTORY.

The following paper is intended to give a summary of our knowledge respecting the best known of the truly viviparous osseous fishes characterized by an intrafollicular or intraovarian development. The only memoirs of importance which have not been consulted in the preparation of this series of notes is that by Rathké,* on *Zoarces viviparus*, and that by Duvernoy on *Pœcilia surinamensis*, which is cited at another place.

The preliminary notice published by me on the development of *Gambusia* appeared nearly four years ago, and left the subject in a very incomplete state. What is here added on the anatomy of the embryos and the follicles may, I trust, be of interest to morphologists.

The new observations here recorded on the changes undergone by the embryos of the Ebiotocoids during gestation, relate to the development of the intestine and the vascular supply of the median fins, both of these organs also undergoing other changes which have appeared to the writer to have considerable significance.

Some apology may be necessary for the long extracts which I have incorporated from the paper by Professor Wyman and Dr. Girard's report, but I think the student who wishes to be spared the vexatious task of finding and consulting authorities will be rather gratified than otherwise to find the American contributions to the subject thus brought together.

I.—The development of Anableps.

Wyman's memoir † on Anableps contains such valuable observations and reflections on the viviparity of fishes that I will here reproduce the most important parts of his paper entire, as follows:

"Extended observations have proved that a large number of species of fishes, belonging to many genera, are truly viviparous, the fœtus passing through a real gestation by the parent before its development is complete. These viviparous fishes may be divided into two groups, according to the position occupied by the embryo during the period of its growth.

"I. In the first group may be arranged those fishes in which *the*

* Bildungs- und Entwickelungsgeschichte des Blennius viviparus oder des Schleimfisches. Abhandl. zur Entwickelungsgeschichte. Zweiter Theil, Erste Abh., pp. 1–68 pls. 5, 4to, Leipsic, 1833.

† Observations on the development of *Anableps Gronovii* (Cuv. & Val.). By Jeffries Wyman, M. D., Bost. Journ. Nat. Hist, vi, 1850–'57, pp. 432–443, pl. xvii.

Vol. VIII, No. 9. Washington, D. C. May 25, 1885.

ovum leaves the ovary in an undeveloped state, and in which the process of evolution is not commenced until it reaches the lower portion of the oviduct. The species which this group comprises are nearly all, if not all, Plagiostomes. The best known are *Spinax*, *Carcharias*, *Mustelus*, *Galeus*, and *Torpedo.* Although they are usually classified among the lowest of fishes, it is in some of them that the process of reproduction becomes most nearly analogous to that of the highest Vertebrates. Not only does the yelk reach proportions like the yelk of birds, but the yelk-sac itself plays the part of an allantois and forms an organ analogous to a placenta. In Spinax the vessels on the surface of the vitelline sac are brought into close contact with the highly-vascular folds which line the oviducts. But in Carcharias, as Müller has demonstrated in his memoir on the subject, not only is there an approximation of the fœtal and maternal vessels, but the surfaces of the yelk-sac and of the oviduct are both deeply convoluted, and the projections of the one are admitted into and embraced by the concavities of the other, and the opposing surfaces become adherent even. In both Spinax and Carcharias the necessary conditions exist for the reaction of maternal and fœtal blood upon each other, as in the case in the mammalia, but to a much more limited extent.*

"II. In the second group those fishes are comprised in which *the gestation is either wholly or in part ovarian*, the last stages only of the process usually occurring in the oviduct. Among the genera included in this division are *Silurus*,† *Blennius*,‡ *Anableps*,§ *Pœcilia*,|| and *Embiotoca*.¶ In all of these genera impregnation takes place in the ovary, and, as seems probable, while the ovum is still invested with its original envelopes. In Blenny, Rathké has shown, the ovarian gestation having continued about three weeks, that about the end of September the sac ruptures, and that the embryo is discharged into the central cavity of the ovary, which is in fact the oviduct; here the fœtus remains till the beginning of January, when it is born. In Pœcilia the fœtus is liberated and escapes into the oviduct towards the end of gestation. Valenciennes has given several details in relation to the development of *Anableps Gronovii*, made for the most part upon specimens in an advanced stage of fœtation, the smallest embryo being more than an inch long. He

* Dr. John Davy has shown that in Torpedo the embryo is nourished at the expense of materials furnished by the parent, since the mature fœtus weighs more than twice as much as the egg at the time development commenced. Philos. Trans., 1834. *On the Development of the Torpedo.*

† Cuvier et Valenciennes, Hist. Nat. des Poissons, t. i., p. 540, 1828.

‡ Rathké, Mem. sur la Develop. de l'Homme et des Animaux, 2^{me} partie, Leipsic, 1833.

§ Cuv. and Valenciennes, Hist. Nat. des Poissons, t. xviii, p. 245, Paris, 1846.

|| Duvernoy, Ann. des Sc. Nat., t. i, 3^{e}, ser., p. 313, 1844.

¶ Agassiz, Am. Journ. of Science, xvi, 2d ser., Nov., 1853.

found only seven or eight fœtuses in the so-called uterus of each female, and each of the young was surrounded by a distinct sac, which he regards as simply an enlargement of the original envelope of the ovum. The mature fœtus he found to be more than one-fourth as long as the parent, and except for the non-development of the ovary was constituted in every respect like the adult, as regards both its internal and external structure.

"For the specimens of *Anableps Gronovii* upon which the following observations were made, I am indebted to the liberality of Dr. Francis W. Cragin, United States consul at Paramaribo, in Surinam. Among them were three males and five females, four of which last were in different stages of gestation. The different individuals varied from 3½ to 9½ inches in length, the females being much longer than the males.

"I. The smallest female measured 3½ inches in length, but on careful examination no traces of an ovary were discovered; its development did not appear to have commenced as yet.

"II. The next specimen measured 7 inches in length and the ovary was in a state of gestation; the fœtuses, four or five in number, measured but five-eighths of an inch. The ovary appeared single externally; was invested with peritoneum, which was supported by a more firm but thin membrane of condensed areolar tissue; on cutting through this the interior was found filled with sacs corresponding in number to the fœtuses and united to each other and the ovarian walls by a very loose areolar tissue. They had no communication of any kind with each other. With the aid of the point of a needle the sacs were easily detached and removed entire with the inclosed fœtus; the envelope was much larger than was necessary to hold the embryo, and the space between the two was filled with a fluid, a portion of which (albumen ?) had been coagulated by the action of the alcohol. In each instance it was ascertained that the young had no connection whatever, vascular or otherwise, with the walls of the sac which inclosed it.

"The external characters of the embryo even at this early stage, as regards its general form and the fins, resemble those of the adult; but no longitudinal black bands were yet visible on the sides; the eye had not acquired the prominence of that of the adult, the cornea was not divided by a transverse band, and the pupil existed in the form of an oval, with its long diameter in a vertical direction, but the sides of the iris had just commenced extending towards the center in order to form the two laminæ, which in the adult give the pupil its singular shape. The umbilical sac forms a spheroidal mass about one-fourth of an inch in diameter, and is sufficiently transparent to allow the folds of the intestine which fill it to be visible. Externally the sac is covered with what appear to be parallel projecting lines, extending from the sides of the abdomen to its most prominent part. These Valenciennes describes as 'vascular striæ' (*stries vasculiformes*).* Such was not the nature of

* *Op. cit.*, ex fol. de planche, 539.

these markings in the specimens which I examined; but, when placed under the microscope, were found to form a peculiar structure, which possibly may have some connection with the process of nutrition in their peculiar mode of gestation.

"The sac itself seemed nearly homogeneous in structure, but the striæ are made up of spherical, or in some cases pyriform or cylindrical, papillæ or villi, projecting from the surface and arranged so nearly together in a linear series as to give the appearance of a continuous band. In regard to the minute structure of these papillæ, as far as it could be determined from an alcoholic specimen, they consist externally of an exceedingly thin membrane, inclosing a vast number of minute granules; no vessels were seen in connection with them nor in the membrane to which they were attached. There was no appearance of any communication between the cavity of the papilla and that of the membrane to which it was attached. Within the latter, but more nearly in contact with the intestines, there was a second more delicate membrane, which seemed to be a continuation of the parietal peritoneum. No traces of the yelk were found in connection with the intestines.

"III. The third specimen is much longer and measures 10 inches in length; the ovary had been ruptured, so that some of the fœtuses had escaped into the cavity of the abdomen, but the whole number of young taken from the parent was much greater than in the preceding case, namely, eighteen; one of these was projecting from the genital opening. They generally resembled the preceding except in size, though the eyes had become more prominent, and the iris now exhibited its lateral projections sufficiently developed to give the pupil the shape of a dumb-bell. The umbilical sac has become much larger than in the embryos first described, and measures three-eighths of an inch in diameter. The papillæ of the yelk-sac are much more distinct, and contain colored granules. The yelk-sac communicates with the cavity of the abdomen by a long fissure extending from a point just behind the union of the opercula nearly as far as the anal opening, consequently beyond the ventral fins. It is from the circumstance just mentioned, doubtless, that an explanation is to be found of the non-union of the ventrals in the adult. The scales terminate abruptly at the edge of the fissure. The intestine, as in the first described embryos, were invested by the internal sac, which was regarded as parietal peritoneum. No bands were visible on the flanks of the body, nor were the anal fins yet modified to mark the sexes. A rudimentary liver is visible in these specimens, extending backwards on the left side of the intestinal mass. The intestinal canal is of almost uniform size throughout, there being no distinction between intestine and stomach.

"IV. This specimen measured a little less than 10 inches in length, but the embryos were of much larger size, having a length of $2\frac{1}{4}$ inches; the umbilical sac had disappeared, but the fissure on the under side of the abdomen still remained, and, what seems quite remarkable, had grown in dimensions just in proportion to the entire fœtus, so that in

these specimens it measured 1 inch in length, and was consequently longer than the whole embryo of the first specimen noticed above. The edges of the fissure were united by the intermedium of a thin membrane, without scales, on which no papillæ were noticed, and was sufficiently lax to allow the edges of the fissure to separate from each other to a slight extent. The transverse band upon the cornea was now distinct, though it had not yet become as opaque as in the adult.

"Seven fœtuses were found in the ovary; on the sides of them one or two dark longitudinal l nes were now visible; the general form of the body had assumed more precisely that of the adult, and, as noticed by Valenciennes, the intestines had obtained their permanent form. The external sexual characters were not visible in any of the specimens examined, though they were seen and figured in specimens of about the same size by Valenciennes.

"All of the fœtuses of this female had escaped from their original sacs (no traces of which were now visible) and were all contained in one large cavity formed by the dilated ovary which now had become analogous to an uterus and extended from the genital opening as far forwards as the bases of the pectoral fins. The walls of this ovarian sac were sufficiently thin to allow the fœtuses to be seen through them. On its inner surface, as well as on that of some of the other specimens, were to be seen numerous immature ova, some of them microscopic and others as large as the sixteenth of an inch in diameter. The co-existence of immature ova on the walls of the ovarian cavity with fœtuses in it corresponds with what was noticed by Duvernoy in his investigations of the embryology of Pœcilia.* The more minute ovarian eggs, though for a long time macerated in alcohol, yet preserved their microscopic characters to a remarkable degree. The smallest consisted of a cell, in the center of which a nucleus was visible, and around this last were a few granules. In the larger ova the granules have become more and more abundant, and in some instances obscure the nucleus or germ-cell. After the egg has increased to a certain size, a clear space appears exterior to the vitelline membrane, which gradually increases to nearly twice the diameter of the egg itself. This clear space is limited by the substance of the stroma, which becomes condensed around it and thus forms a distinct sac. If the ovum be compared to that of a mammal, then the sac just described may be said to be analogous to a Graafian vesicle; that is, the egg of the fish floats free in a sac much larger than itself, just as the mammiferous egg does in the vesicle of De Graaf. There were no intermediate conditions between this and the impregnated condition to enable me to determine whether or not it is this sac which formed the external covering of the fœtus. Valenciennes seems to adopt the idea that it does, and compares it to a chorion.† If this view

* Sur la developpement de la Pœcilia surinamensis, Ann. des Sci. Naturelles, 3e ser., i, p. 313, 1814.

† La cellule qui contient un oeuf fécondé s'aggrandit et finit par former une sorte de chorion. *Op. cit.*, t. xviii, p. 261.

of its nature be true, then there seems no alternative, since development advances so far before the sac ruptures, but to suppose that impregnation must take place through its parietes and that the spermatozöon cannot enter bodily into the substance or even come in direct contact with the vitelline membrane of the egg except through the walls of its outer covering, which is not probable. It would seem that it must act simply by its presence on the surface of the egg-sac or by an endosmosis of its fluid contents through the membranes by which the ovum is invested.*

"A microscopic examination of the egg-sacs in the advanced fœtuses proves conclusively that they do not consist of loose areolar tissue only, as stated by Valenciennes,† but that while the tissue in question forms the basis of them, they are in reality highly vascular, large trunks and minute ramifications of vessels being easily traced by the aid of the coagulated blood which they contain.

"In comparing fœtuses of different stages of development together, a very interesting question is presented to us in connection with their growth. In the smallest specimen examined, the yelk was no longer visible; it had been wholly consumed in supplying materials for the formation of the embryo; and yet subsequent to this disappearance of the yelk, the embryo, while still in its ovarian sac and cut off from all external communication, continues to increase in size, and grows until it acquires the length of an inch and a quarter, which gives the size of the longest fœtus which our specimens furnished. Even the umbilical sac and the fissure which succeeds it continue to grow after the yelk has disappeared. As a general rule among oviparous fishes, the yelk supplies *all* the material required for the growth of the fœtus; and the same holds good with regard to nearly all Batrachians,‡ to scaly reptiles and birds. So general has this rule been believed to be, that none but mammals have been supposed to contribute anything beyond the materials of the egg to the support of the young. But recent observations go to prove that some fishes, such as the Torpedo among the Plagiostomes, the Embiotoca among osseous fishes, are to be placed in the same category as mammals, in relation to the fact of being nourished by the parent during gestation, although neither a placenta is formed nor does any direct vascular communication whatever exist between the fœtus and the maternal circulation. We cannot explain the growth of the fœtal Anableps by any other hypothesis than that it is nourished by a fluid secreted by the walls of the sac in which it is lodged in the earlier stages, or by the parietes of the general ovarian cavity in which the fœtuses are received towards the end of gestation. The high degree of vascularity of the egg-sac is favorable to this supposition. As

[*See description below of the follicular pore in *Gambusia*.]

†*Op. cit.*, p. 261.

‡The only exception among Batrachians, as yet noticed, is found in the Pipæ of South America. See Observations on Pipa Americana, by Jeffries Wyman, M. D., in American Journal of Science, 2d series, vol. xvii, p. 369.

the body of the fœtus at a very early period becomes covered with scales, absorption could only take place through the intestinal canal or by the surface of the yelk-sac, which invests the viscera and increases in size for a long period after the yelk itself has wholly disappeared. In the later stages of gestation even the yelk-sac is out of the question, since it in turn wholly disappears, while the fœtus occupies the general cavity of the ovary."

Great interest attaches to the peculiar development of the rows of papillæ on the empty yelk-bag of *Anableps* as described above by Wyman. Its continued growth with the growth of the fœtus up to a certain stage of advancement is also remarkable; in fact, so far as yet known, it is unique amongst osseous fishes. The peculiar character of the villi on the yelk-bag remind one somewhat of what has been observed by Osborn in the structure of yelk sac of the uterine fœtus of *Didelphys*, and by Owen in *Macropus*, in which the fœtal membranes fitted into uterine furrows, but were not adherent to the uterus and without villi. This structure in *Anableps* also reminds one of the hollow villi developed in certain mammalian blastodermic vesicles described by Bischoff. It is therefore unfortunate that Professor Wyman was not in a position to describe the minute histological structure of this abdominal sac in the fœtus of *Anableps* more fully, so that a more exact comparison could have been instituted between it and the yelk-bag or inferior pole of the blastodermic vesicle of the Marsupialia. A knowledge of the embryonic layers which enter into the formation of the yelk-bag of *Anableps* would also be a desideratum.

The extension downwards of the intestine of the embryo of *Anableps* into the empty yelk-bag is also interesting and reminds one somewhat of the peculiar protrusion of the hind-gut of Embiotocoid embryos into an inferior saccular diverticulum of the back part of the abdomen, which is obviously not homologous, however, with the globular, bag-like structure seen in the former.

Wyman does not state whether he examined the surfaces of the ovarian membranes in the earliest stages of development of the papilliferous sac to see if they did not present pits or crypts into which the papillæ may have fitted. These papillæ are obviously in some way connected either with the respiration of the fœtal *Anableps* or with its nutrition in the same way as are the marginal lobes of the fins of the fœtal Embiotocoids.

II.—The development of the Viviparous Surf-perches or Embiotocidæ of the Pacific coast.

Dr. Girard* states that the discovery that these fishes were viviparous was made in May, 1852, in San Diego Bay, California, by Dr. Thomas H. Webb, whose manuscript journal is quoted by Girard.

*Explorations and Surveys for a Railroad from the Mississippi River to the Pacific Ocean. IV. Fishes. 4to. Washington, 1858.

The following observations of his own have been put upon record in the latter's report, cited below; but it is evident that he overlooked the peculiar vascular lobes appended to the vertical fins of the embryos noticed by Blake, and also drew some erroneous inferences as to the identity of the yelk-sac, which will be noticed later. From pages 165 to 166, inclusive, of Girard's report the following paragraphs are quoted:

"But the most remarkable trait in the organization of the fishes of this family consist in the mode of reproduction. The eggs, instead of being laid, as is the case in most fishes, are retained within the body of the female, where they undergo not only their embryonic growth, but likewise a growth which might be termed larval, it being subsequent to their escaping from the egg envelope, until they have attained a size sometimes of several inches in total length. Nevertheless this peculiarity of habit is not altogether without analogy in the class of fishes. Moreover it bears no resemblance whatever to the marsupialian gestation; in the first place the eggs develop in the ovary, not in a uterus, and there is no placental connection of any sort; secondly, the young are not at liberty to quit and enter the ovarian cavities alternately and at pleasure.

"The observations which we have made upon the genital apparatus of the female have satisfied us that there exists an ovarian sheath or sac, which during the early period of pregnancy is an elongated and subcylindrical tube, containing the ovaries proper, two in number, each of which consist of two, three, or more vascular membranes, attached by their upper edges to the upper floor or roof of the sheath, forming either one or two pouches (according to the number of these membranes) of the same length as the sheath itself, widely open beneath, though not in direct communication with one another, since the membranes hang loosely down, reaching the lower floor of the sheath.

"The eggs are formed within the texture of the ovarian membranes themselves. We have examined the ovaries of *Ennichthys heermanni* and *Embiotoca argyrosoma* when the sheath within which they were contained was not larger than an ordinary quill. Numerous eggs could be observed in a very immature state, appearing to the unarmed eye like minute dots. Under the microscope they exhibited evident traces of the germinal vesicle, surrounded as yet with a very scanty supply of vitelline substance.

"The sheath and the ovaries are gradually increasing in bulk, as the eggs themselves first increase in size and the embryos afterwards. The sheath is chiefly a muscular membrane, while the ovaries, we have stated, are altogether vascular.

"When mature the eggs either fall into the space between the membranes or ovarian pouches, or else remain attached to the ovaries until the embryos issue out of them. We are inclined to think that they drop into the pouches as eggs. At any rate we found very young em-

bryos loosely contained in the ovarian pouches when no trace of the egg-membrane could be seen within the tissues of the ovaries in the shape of a *corpus luteum* or a Graafian vesicle. Whatever be the case, numerous eggs or embryos may be observed within one pouch. The young thus remain together until grown to a considerable size, when, filling up the space in a more compact manner, the ovarian membranes, in their nature very expansive, will extend a fold between each embryo. In this manner every individual young, when removed sideways from the ovary, appears to the operator as though inclosed in a separate cavity, pouch, or follicle of the ovary, whilst in reality the membranes may be stretched out or extended, and the entire progeny loosened from all adherence or connection with them.

"The male organs of generation consist of two spermaries, a right and a left, perfectly independent from one another, having each its separate duct, discharging their contents into an elongated cloaca, into which the bladder likewise empties its contents. This cloaca communicates with the exterior by a subcircular opening, the edge of which is rather protruding. Such is that apparatus, the same in its general structure as in the other osseous fishes. There is no sheath inclosing the two spermaries, and this fact throws considerable light upon the morphology of the ovaries; the latter being, in fact, two in number, but so closely connected together as to simulate a single organ. Thus the general disposition, not the plan of structure, of these organs is adapted to the mode of reproduction; a single sheath being a more simple adaptation than two, one for each ovary.

"How the mechanical act of fecundation takes place we are not prepared to say from direct observations; the eggs themselves must be fecundated within the ovarian sheath; a copulation of some sort is, therefore, required, and it is not improbable that at this period the eggs have dropped from the ovarian membranes into the pouches or spaces between these membranes in which they are freely floating."

Then follow some observations on the development of the embryos which are to a great extent erroneous, the "abdominal bag," alluded to as the yelk-sac, being probably the same as what I have determined to be the greatly hypertrophied hind-gut which protrudes from the ventral aspect of the body of the embryos. The cleft of the mouth, it is also stated, is not apparent at the time the fins began to grow out. This is also to be seriously doubted, and is a statement which probably rests upon defective observation, as I find the vent to be perforate at the time the embryos are an inch in length.

Farther on Dr. Girard, speaking of the embryos of *Ditrema jacksoni*, six to seven tenths of an inch long, "The yelk-bag was still to be observed in the shape of a hernia under the abdomen."

In *Embiotoca perspicabilis*, Girard states, *op. cit.*, page 179, that "a female on being opened was found to contain about eighty young of an average size of half an inch, the whole embryo consisting of cells

with no signs of the mouth. A layer of black pigmentum constituted the eye. Membranous ridges above and below showed the first steps in the formation of fins. The caudal itself was a mere membranous expansion of the cellular substance of the body. As such, the embryos had made their escape from the eggs."

Under *Phanerodon furcatus*, page 185, Girard again mistakes the protruding hind part of the intestine for a yelk-bag. On page 195, in embryos of *Holconotus rhodoterus*, from three-quarters to an inch in length, he speaks of this part of the intestine as "a vitelline abdominal sac."

An examination of the figures of the immature ovarian ova of Embiotocoids has served to convince me that those figured by Dr. Girard were very far from mature, and can give us but a slight conception of what they are like when ripe, because he represents the germinative vesicle as still central. The general rule that the nucleus breaks up and leads to the formation of a new nuclear center in an eccentric position in the egg will probably be found to hold in the Embiotocoids as in other fishes.* As Girard states, I find them embedded in the substance of the thick membranes which depend from the roof of the ovarian cavity.

The youngest fœtus figured by Girard is also pretty well advanced, all of the vertical fins being already defined. The comparison also of these youngest fœtuses hitherto figured with some somewhat older which I have had the opportunity to investigate, leads me to believe that the former were much farther advanced than was supposed by that author. His figures of the fœtuses are poor, and give a very imperfect idea of what it must actually have been possible to see. His statement that the mouth was still closed I am also inclined to doubt, while his observations on the development of the eye are simply calculated to force a smile. He has clearly mistaken the protruding and hypertrophied hind-gut in all of his figures for a yelk-bag, the latter having probably vanished long before, and at a point somewhat in advance of what he regards as the yelk.

III.—The hypertrophied hind-gut of Embiotocoid embryos and its subsequent diminution in relative size.

The hypertrophied hind-gut of Embiotocoid embryos which protudes into a sac-like downward projection of the abdominal profile is the most important of the embryonic visceral organs. Upon opening the abdominal cavity it is found that it fills up fully two-thirds of the latter, and that its dimensions, especially the transverse diameter of the gut, is far greater than the portion of the canal which subsequently becomes the stomach. Upon cutting this swollen hind-gut open its walls are found to be thickly clothed with crowded villi of the most extraordinary length, many being entangled together at their tips, and much

* See the law of nuclear displacement and its significance in embryology, Science, i, 1883, pp. 277, 278.

bent. If extended some of these villi would more than reach across the lumen of the intestine. This is their condition in the fœtuses of several species of Embiotocoids examined by me ranging from 1 to $1\frac{1}{4}$ inches in total length.

As development proceeds the gut begins to assume its normal dimensions posteriorly. It becomes narrower, and the sigmoid turn or flexures of the intestine more pronounced. The villi also diminish in length, and become far less numerous in fœtuses $1\frac{3}{4}$ inches long. At this stage, also, the projection of the rectum below the abdominal profile becomes less marked, and in fact is scarcely apparent.

In the adults the posterior part of the intestinal canal exhibits no such dilatation and dense internal garniture of villi as is seen in the fœtus; in fact, the hind-gut of the fully-grown fishes presents nothing unusual when compared with that of the usual type.

It is therefore obvious that this hypertrophy of the hind-gut and remarkable development of elongated villi in the embryos of the surf-perches has some important function to subserve during fœtal life. As suggested at another place, that function seems to be digestive; and as it is not at all improbable that the fluids secreted by the walls of the ovarian sac are nutritive; it seems likely that the fœtal fishes swallow such nutriment while still in the ovary. If Dr. Blake is correct in stating that the ovarian duct is occluded by a mucous or membranous plug during gestation, this interpretation of the function of the gut of the embryo would seem all the more likely to be the correct one.

IV.—The intra-ovarian respiratory function of the vertical fins of Embiotocoid fish embryos.

Two papers on the intra-ovarian gestation of the embryos of the *Embiotocidæ*, *Holconoti*, or surf-perches of the Pacific coast have been published by Dr. James Blake,* in the first of which the singular vascular lobes extending beyond the rays of the vertical fins, as productions of the inter-radial membranes, are for the first time described and figured.

I reproduce the following from Dr. Blake's second paper, as it will serve to indicate the extent of his contributions to the subject under consideration:

"The manner in which the young of the Embiotocoid fishes is nourished until it escapes from the ovary has not, that I am aware, been satisfactorily explained. In this class of fishes the young remain in the ovary until they are apparently as perfect as the adult fish. As during the process of gestation the ovary is cut off from all communication with the water, the external orifice being sealed up by a dense layer of epidermis or inspissated mucus, it is evident that the fœtal fish must

* 1. On the nourishment of the fœtus in the Embiotocoid fishes. Proc. Calif. Acad. of Nat. Sci., iii, 1867, pp. 314–317, 3 figs. in text.

2. On the nourishment of the fœtus in Embiotocoid fishes. Journ. Anat. and Physiol. ii, 1868, pp. 280–282.

receive the elements of its growth from the interior of the ovary, and that it must be furnished with organs of absorption and respiration suited to the medium in which it is developed. A large supply of nourishment must evidently be required, as the ovary contains frequently forty or fifty young fish, which, when fully developed, measure more than 2 inches in length, and which together will weigh from one-twelfth to one-sixteenth as much as the parent fish. The ovary consists of a membranous bag partially divided at the upper (anterior) part, and terminating below in a narrow canal, which, in some species, opens externally in a cloaca common to it, and the urethra in others by a separate opening situated between the anus and urethra. The sac has three coats—a peritoneal, a muscular, and a mucous. The mucous layer is thrown into a number of longitudinal folds, and on the inner surface of the ovary the ova are found; and as the fœtal fish grows these folds extend so that each fœtus is in contact by each of two surfaces with the mucous membrane. The organ is well supplied with blood-vessels, an artery entering at each horn of the ovary. They arise from the aorta immediately after the union of the branchial arteries, and at the latter end of gestation each is larger than the descending aorta. The posterior part of the uterus (ovary) also receives vessels from the abdominal aorta. In the early stages of development the fœtus is embedded in a very tenacious secretion, which resembles para-albumen in that it can be drawn out into threads of a foot or 18 inches long. As gestation advances the secretion of the ovary becomes more fluid, and its quantity is increased so that as much as three drams can be obtained from one ovary towards the end of gestation. It then forms an opalescent fluid, specific gravity, 1.025; does not coagulate on heating; acetic acid throws down a white precipitate, mixed with equal parts of distilled water, and filtered, it has no action on polarized light; heated in an open vessel, a pellicle forms on the surface. It probably contains some albumen-compound, fat, salt, phosphates, and iron; but it has not been submitted to a careful analysis.* The fœtus during the earlier stages of its development goes through changes apparently analogous to those which take place in the ova of oviparous fishes, and it is not until the fins are formed that any departure from the ordinary plan shows itself. As soon as the fins were well formed the dorsal, caudal, and ventral (anal) fins became edged with a delicate membrane formed apparently entirely of capillary blood-vessels. As the fœtus grows this membrane is split up into processes or digitations, which extend a considerable distance beyond the margin of the fin, sometimes as much as a quarter of an inch. They retain the same structure during the whole period of development, and are so extremely

* This fluid is usually expelled from the ovary by the struggles of the fish when taken from the water, so that it is extremely rare to find one in our market in which the membrane closing the orifice of the ovary has not been ruptured. This is probably the reason that it has not been already noticed.

delicate that I have been unable to detect them in any specimens preserved in alcohol. As soon as the young fish is expelled from the ovary these processes rapidly diminish in size, and I have no doubt they entirely disappear after a few hours. Their use is evidently to absorb nourishment from the fluid in the ovary; they also serve to aerate the blood, for I have observed that on heating the fluid from the ovary, or on mixing it with ether, there is an abundant escape of gas. I think these facts serve to explain the manner in which the fœtus of the Embiotocoid fishes is nourished during its intra-ovarian development. They have been frequently observed in the three varieties of this sort of fish which are found in our waters."

Within a very recent period, through the kind offices of Miss Rosa Smith, of San Diego, Cal., I have been enabled to obtain some well-preserved material for purposes of study, which, while it enables me to add considerably to our knowledge of the development of these singular fishes, also impels me to differ to some extent from the conclusions of Dr. Blake. Miss Smith, at no little trouble to herself, obtained for me gravid females of *Amphistichus arenatus*, *Ditrema jacksoni*, and *Micrometrus aggregatus*. Unfortunately this material, as well as some in addition which I have obtained through the kindness of Dr. Bean from the collections of the National Museum, represents only the more advanced stages of fœtal development, so that I am unable to add anything to the very little which is known of the earliest stages of development. Judging from the dates upon which the specimens collected by Miss Smith were taken, it would seem probable that during the months of October and November one would probably find the earlier stages which are so desirable in order to clear up what must evidently be a most interesting chapter in vertebrate embryology.

The most striking characteristic of the fœtal surf-perches, as they lie in the ovarian sac of the parent fish, is the exaggerated development of the vertical or median fins, all of which combined present a lateral area almost or quite as great as the united areas of the side of the head, body, and tail. These fins present an exaggerated length and height nowhere approached by the adults, and not exceeded in respect to the width and relative length of the caudal fin by any fishes except perhaps some of the domesticated Japanese breeds of *Carassius*, such as the Kin-yi-ko. This extension of the area of the vertical fins is still further increased by the production of the interradial membrane into thin, highly vascular processes or marginal digitations. These Dr. Blake has already described, but he has not mentioned the very extraordinary way in which these structures acquire their blood-supply, which is, so far as I am aware, unique amongst young fishes, though faintly approximated by the arrangement of the blood-supply seen in the enormously developed translucent caudal of the Kin-yi-ko, as I have had the opportunity to observe in the living fish.

Description of the vascular supply of the vertical fins of Embiotocoid

embryos will be necessary before it is possible to comprehend the meaning and importance of the vascular digitations at the edges of those fins. All of them receive their blood-supply from the median aortic trunk.

The trunks given off to the dorsal fin traverse the median plane of the body and tail, and pass up in a nearly straight direction to the base of the dorsal, at irregular intervals of one, two, or even six muscular segments. Upon reaching the base of the fins they subdivide into from two to six branches, which pass up a little to one edge of the interradial space, but give off smaller trunks along their entire course through the interradial membrane, which is highly vascular. Continuing they proceed to the margin of the fin. They end in a flat sieve like capillary mesh, which fills up almost the whole of the marginal lobes formed by the prolonged interradial membranes. The tissue of the walls of the vessels within these terminal interradial lobes seems to be mesoblastic, but their external walls next the exterior seem to be mostly epidermic and exceedingly thin, probably not more than three or four cells thick. The capillary mesh is most complex and finest in the terminal lobes, less so in the interradial spaces.

The digitations on the spinous portion of the dorsal are very feebly developed, in fact scarcely apparent between the tips of the nine spines of the spinous part of the dorsal of a fœtus of *Micrometrus aggregatus*, a species in which these spines develop, by the way, in a continuous fold, and not in separate pockets or diverticula as in *Lophius* and *Gasterosteus*.* Four principal vessels supply the interradial and terminal capillary meshes of the soft dorsal with blood. These four vessels pass in an almost vertical direction from the aorta to the base of the fin, and do not follow the curvatures of the intermuscular septa. No vessels of unusual caliber pass to the spinous part of the dorsal.

The terminal or marginal interradial lobes of the anal of the fœtus of *Micrometrus* are twenty-six in number, or three in excess of the dorsal, while the two spaces between the anterior spines of the anal are without produced vascular lobes. Five principal vascular trunks pass vertically downward to the base of the anal, where they subdivide and supply each of the interradial spaces. The marginal lobes of the anal and dorsal are about alike in length and all have a marginal vessel circumscribing the capillary mesh at their edges. In this last respect they are like the terminal lobes of the caudal, in which they are, however, somewhat larger and longer.

From what has been said above it will be noticed by the reader that the number of vascular trunks passing outward to the bases of the vertical fins does not correspond to the number of rays which they contain. This fact indicates that this singular vascular supply of the vertical fins of Embiotocoid embryos has attained great specialization and must be of very great physiological importance.

This fact is rendered still more striking when we come to consider the vascular supply of the caudal fin, which is quite unique so far as I

* See Am. Naturalist, 1885, p. 415.

am aware amongst existing fish embryos. In the caudal, the posterior extremity of the aorta is prolonged backward, slightly bent upward, to beyond the anterior ends of the rays where it divides into two branches, a ventral and a dorsal one, each running nearly vertical to the axis of the body along the base of the caudal. From their posterior sides these two branches each give off about eleven or twelve secondary twigs which run out along and between the rays through the interradial spaces to supply the capillary mesh-work of the latter and the terminal lobes.

The membranous fold which is continued forward dorsally and ventrally from the base of the caudal, and which is a remnant of the continuous median fin-fold of an earlier stage, is also very vascular, but gets its blood supply from vessels arising from the aorta in front of the caudal. The foregoing is the arrangement of the vascular system of the fins in fœtuses about 1 inch in length. On comparing this stage of *Micrometrus* with *Amphistichus* 1½ inches long, it was observed that the vascular apparatus above described had already begun to diminish in importance, and in the adults nothing could be found which exactly represented it. The conclusion, therefore, is that like the vessels which render the skin of the fœtal Embiotocoid so highly vascular, this system atrophies for the most part after having temporarily subserved some important function.

The skin of the fœtal *Micrometrus* was highly vascular, and it was observed that special trunks passed outwards to the skin along the sides, these vessels arising for the most part above the aorta from the sides of the vessels which passed to the dorsal and the muscles of the tail. The vascular network beneath the skin is remarkably well defined and could obviously not be for the purpose of supplying the skin alone with blood.

The complex and unique vascular apparatus of the vertical fins of Embiotocoid fish embryos it seems to me to be mainly for the purpose of effecting respiration through the skin, and not for the purpose of absorbing nutriment from the ovarian space as Dr. Blake, has supposed. My reason for entertaining such an opinion is the fact that the mouth of the fœtus is now open and that the throat is perforate, and that the back part of the intestinal canal is widened and clothed internally with extraordinarily long and densely crowded villi. In fact this part of the intestine has been hypertrophied in the fœtus, and while there was no food found by me in the alimentary canal, I cannot but believe that this part of the intestine is already functional and subserves all of the purposes of the alimentary apparatus of the adult, and that the albuminous substances secreted in the ovarian cavity are swallowed by the fœtus, and finally digested by the peculiarly organized hind-gut which I have described. There is, therefore, it seems to me, nothing left to do for the produced vascular membranes of the fins and the skin except to aid the gills in respiration, the interchange of gases between the parent and the fœtus taking place through the fluids contained in the ovarian cavity, and in much the same manner as in *Gambusia*. The

structure of the median fins of these embryos is such that, while their marginal lobes somewhat resemble the fœtal villi of the mammalian placenta, they differ from the latter in not being received into maternal crypts, which I diligently but vainly sought for on the surface of the folds which depend from the dorsal wall of the ovary.

The vascular net-work of the ovary by which the maternal blood is brought into indirect contact with the marginal lobes of the vertical fins of the fœtuses is derived from a strongly-developed pair of vessels which enter the two anterior cornua of the ovarian sac. These give off branches to the dorsal, thickened wall of the sac and others to the pendent membranes which extend downwards from its roof, between which the advanced fœtuses are packed in a somewhat irregular manner.

V.—The development and intrafollicular gestation of Gambusia patruelis.

During a temporary residence at Cherrystone, Va., in August, 1881, my attention was directed by Col. M. McDonald to the existence of a small Cyprinodont in the fresh-water streams of the vicinity. The females were gravid, the ovaries of most consisting of twenty to twenty-five yellowish eggs about one-twelfth of an inch in diameter. This species, which proved to be *Gambusia patruelis* of Baird and Girard, does not, as do most other fishes, commit its ova to the care of the element in which it lives, but carries them about in the ovary, as do most of the members of this family, where they are impregnated and where they develop in a very remarkable manner.

Of the manner of impregnation of the female we know very little except from the observations of Mr. Duly, who has related to me what he has noticed in the actions of the adults kept in aquaria in the National Museum. I have appended Mr. Duly's observations at the end of this paper.

In the adult male, which measures $1\frac{1}{8}$ of an inch in length, the anal fin is strangely modified into an intromittent organ for the conveyance of the milt into the ovary of the female; a tubular organ appears to be formed by three of the foremost anal rays, which are greatly prolonged and united by a membrane. At the apex these rays are somewhat curved toward each other, and thus form a blunt point, but the foremost one of the three rays is armed for its whole length with transverse ridges, and with sharp recurved hooks at its tip, the other two at their tips similarly with hooks, and between their tips are two small fenestra or openings which possibly communicate directly with the sperm duct from the testes. The basal interspinous bones of the anal fin are bound together by fibrous tissue into a cylindrical columnar bony mass, truncated above, and is prolonged upwards from the inferior abdominal parietes behind the anus into the cavity of the air-bladder for the distance of nearly the eighth of an inch; from the upper truncated end and the posterior side of this column a series of fibrous

bands pass to the dorsal and posterior wall of the air-bladder, to be inserted in the median line. Whether this bony column serves to steady the fin in the act of copulation, or whether it serves to give passage to the sperm duct are unsettled questions with the writer. The modified, almost styliform, anal fin of the male measures a third of an inch in length, or nearly one-third of the total length of the fish.* Other peculiarities of the male are noticeable, for instance, the more abbreviated air-bladder, which also occupies a more oblique position than in the female. The most remarkable difference presented by the male as compared with the female, however, is his inconsiderable weight, which is only 160 milligrams, while that of the gravid female is 1,030 milligrams, or nearly six and one-half times the weight of the male, an unusual difference in the relative sizes of the two sexes amongst fishes.

The adult female, as already stated, is heavier than the male, and measures $1\frac{3}{4}$ inches in length. The liver lies for the most part on the left side. The intestine makes one complete coil or sigmoid flexure upon itself in the anterior half of the body-cavity; its posterior third passes back along the floor of the abdominal cavity, and at the posterior end of the latter the Wolffian ducts traverse it vertically, to be enlarged near their outlets into a fusiform urinary bladder.

The ovary is a simple, unpaired organ, the greater part of which lies on the right side of the body-cavity below the air-bladder, and serves to fill up the greater part of the inferior moiety of the former when developed to maturity with its follicles gravid with embryos. The ova, when full grown, are each enveloped in a sack or follicle supplied with blood from a median vascular trunk, which divides and subdivides as it traverses the ovary lengthwise in a manner similar to that of the stem to which grapes in the bunch are attached. The arrangement of the ova and their attachment to the median vascular rachis is well shown in Fig. 11, Plate VIII, in which the immature ovarian eggs are also represented as small whitish bodies attached to the sides of the vessels. In Fig. 10, Plate VIII, two of these immature ovarian ova are also shown close to the *follicular pore* of a follicle containing an advanced fœtus.

Every fully-grown ovum, by means of the preceding arrangement, has its own independent supply of blood from the arterial system of the mother, the ovarian arterial trunk being a branch of the median dorsal aorta. Each egg and egg-sac is thus supplied with materials for its growth and maturation, the latter eventually becoming specialized into a contrivance by which the lives of the developing embryos are maintained while undergoing development in their respective follicles. The young or unripe eggs which are found together in the same ovary with the developing fœtuses are, as stated above, enveloped in a cellular and fibrous stroma, which serves not only to strengthen the vessels, but

*The anal fins of the males of closely allied species of *Gambusia* and of *Limia*, from Cuba, are similarly modified, according to Prof. Felipe Poey, who has figured those observed by him in his Memorias sobra la Hist. Nat. de la Isla de Cuba, i, pp. 382–387, pls. 31 and 32. Habana, 1851.

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also afterwards enters into the structure of the walls of the ovarian sacs or follicles externally, as these grow in size.

The immature ova measure from a hundredth to a fiftieth of an inch, and enlarge to something more than a line in diameter, when they may be said to be mature. The median vessel of the ovary extends backward and slightly downward, and arises very far forward in the roof of the body-cavity from the dorsal aorta.

The ova after developing a little way are each inclosed in a follicle or ovisac, *membrana granulosa* of Von Baer, or *membrana cellulosa* of Coste. As the egg develops there seems to be a space gradually formed about it in the same way as described by Wyman in *Anableps*. This space is filled with fluid, and in this liquid, which increases in quantity somewhat as development proceeds, the embryo Cyprinodont is constantly bathed.

There is no trace whatever in the egg follicles of Gambusia of an independent egg membrane, such as is present in the ova of all known forms of osseous fishes which spawn directly into the water, the egg membrane or *zona radiata* of the latter, in all cases being perforated by a minute pore or micropyle for the passage of the spermatozoa. The condition in *Gambusia* raises the question whether the *zona* is not more or less completely aborted, sooner or later, in all viviparous fishes. Wyman, however, points out that a membrane exists, covering the immature ovarian eggs of *Anableps*, and I find that the mature eggs of *Fundulus* are provided with a strong zona radiata during the early stages of their intra-ovarian development; how long it persists, however, has not been determined, as it is possible that it is disintegrated and absorbed during the later stages of gestation. Rathké's description of the ovarian follicles of *Zoarces* agree in some respects pretty closely with my account of the egg-follicles of *Gambusia* given farther on. The narrow elongate stigma, devoid of vessels, on the follicle, spoken of on page 4 of his memoir on Zoarces, probably corresponds to what I have called the *follicular pore*. He has described a vascular net-work in the follicle, a stalk joining it to the vascular rachis, and a space around the yelk much as in *Gambusia*.

The zona radiata, or covering of the eggs of osseous fishes, is said to be secreted from the cells lining the follicles, and is composed of a strong, somewhat gelatinoid substance, and is usually, though not always, perforated all over by a vast number of extremely fine tubules, called *pore canals* by their discoverer, Johannes Mueller. In the yellow perch (*Perca flavescens*), the zona radiata is well marked, but external to it there is a highly elastic layer many times thicker, which is traversed by what seem to be tubules, which are, however, much less numerous than those of the true zona. In the ova of closely allied forms, such as the white perch and r ck-fish or striped bass, this extra external envel-

ope is wanting. In the ova of the Ganoids, *Amia* and *Lepidosteus*, the *zona* is composed, in the first instance, at least, of short, parallel, elastic fibers disposed in a plane vertical to that of the membrane, these fibers being fused at their ends or just below the inner and outer surfaces of the membrane. Sections through the egg membrane of *Lepidosteus* seem to indicate the same condition of things as in *Amia*, in fact, Dr. E. L. Mark, of Cambridge, Mass., has kindly shown me drawings which show the fibers of the zona of the former isolated in the same condition as I have been able to separate those forming the egg-membrane of the latter.

The egg-cases of the oviparous Plagiostomes have a different structure from the zona investing the ova of osseous fishes in that they are fibrous in structure and of a horny consistency, the fibers running in a direction parallel with the surfaces of the case. The ovoviviparous forms, judging from the character of the egg-cases of *Squalus*, have the walls of the case extremely thin, apparently to facilitate the interchange of the gases needful in fœtal respiration during development in the oviducts.

The skate's eggs have two hollow processes at each end of the peculiarly formed case, which are perforated at the sides and which afford passage for the water in and out of the case needful for the respiration of the developing embryo. The egg-case of *Heterodontus* or *Gyropleurodus*, a specimen of which has been sent me by Miss Rosa Smith, may be compared to a skate's egg, which is narrower at one end than at the other, but which has been molded into a spiral form during its formation in the oviduct, and which has traces at either end of openings which are apparently homologous with those found in the latter.

The preceding data render it evident that there is a wide range of variation in the character of the investments which cover the ova of different species of fishes, and it is obvious that, while all of the various forms are for the purpose of giving protection to the ovum, some of them are modified to minister to the respiration of the embryo. In other cases a modification of the membrane such as exists in the adherent ova of *Amiurus*, may have still another function to subserve, viz, that of enabling the male parent to aerate the eggs without injury during his apparently violent movements over them with his anal and ventral fins. In *Amiurus* a double membrane invests the egg; an outer highly elastic one separated from the inner or true zona by a shallow space filled with water, but attached to the latter by irregularly disposed elastic pillars of the same material as the outer envelope. The outer envelope is also very adhesive, so that the masses of ova in their elastic investments may be repeatedly moved about or shaken up by the old fish without injury or risk of detachment.

The variability of the egg-membranes of the class *Pisces*, as restricted by Jordan, is rendered still more striking when the types with filamentous appendages, such as *Menidia*, *Belone*, *Exocœtus*, and *Gobius*, are considered. No trace of such a structure existing as a covering for the

egg of *Gambusia*, we are in a position to ask the question why such an unique condition of affairs should exist in this case. The answer, it would appear, we need not go far to seek. In the case of eggs which ordinarily hatch in the water it is necessary that they should be supplied with a covering more or less firm and capable of protecting the contained embryo, which, in the case of *Gambusia*, is not needed, because the embryo is developed so as to be quite competent to take care of itself as a very well organized little fish when it leaves the body of its parent. Nature will not waste her powers in an effort to make useless clothes for such of her children as do not need them; on the contrary, she is constantly utilizing structures economically, and often so as to serve more than one purpose at one and the same time.

The ovarian follicles of *Gambusia* containing mature ova or fœtuses are built up internally of flat or squamous polygonal cells of pavement epithelium, and externally of a net-work of multipolar, fibrous connective tissue cells and minute capillary blood-vessels with cellular walls, which radiate in all directions over the follicle. From the point where the main arterial vessel enters it, this vessel, together with its accompanying vein and investment of fibrous tissue, constitutes the stalk by which the follicle and its contained naked ovum is suspended to the main arterial trunk and vein. The minute structure of the follicular membrane is shown in Fig. 14, Plate IX; the capillary system of the follicles converges by way of the veinules which join the large median ovarian vein which follows alongside the course of the ovarian artery back to the heart. The very intricate mesh-work of fine vessels which covers the follicle supplies the developing fœtus with fresh oxygen, and also serves to carry off the carbonic dioxide in much the same way as the placenta or after-birth performs a similar duty for the young mammal developing in the uterus of its parent. There is this difference, however, between the fœtal fish and the fœtal mammal: In the former there is no uterus; the development takes place in the follicle in which the eggs have grown and matured; there is no placenta, but respiration is effected by a follicular mesh-work of blood-vessels, and the interchange of oxygen and carbonic dioxide takes place through the intermediation at first of the fluid by which the embryo is surrounded in its follicle, and later, when blood-vessels and gills have developed in the embryo (see Fig. 17, Plate IX), they, too, become accessories to aid in the oxygenation of the blood of the fœtus.

In the mammal, on the other hand, there is a uterus; the egg must leave its ovarian follicle; be conveyed to the uterine cavity before a perfectly normal development can begin; there is a fully developed, richly vascular placenta joined to the fœtus, the villi or vascular loops of which are insinuated between those developed on the maternal surface of the uterine cavity. In both fish and mammal, however, the following general likeness remains, viz, that there is no immediate vascular connection between mother and embryo. In both the respiration of the embryo is effected by the transpiration of gases through the intermediation of

membranes and fluids, oxygen being constantly supplied and carbonic dioxide carried off by means of a specialized portion of the blood-system of the maternal organism.

There is still another character which distinguishes the development of *Gambusia* from that of the mammal. The body of the former is built up by a gradual transformation or conversion of the substance of the yelk into the various structures which make up its organization. In other words, the young *Gambusia* obtains no nutrition from its parent; there is merely an incorporation by the embryo of the stored protoplasm of the yelk-sac. In the Eutherian mammal, on the other hand, hand, the embryo receives nourishment through the placental apparatus; by far the greatest proportion of the embryo being built up from the protoplasm supplied and conveyed to it from the blood-system of the parent. Judging from the large size of the young of some viviparous fishes, such as those of *Anableps* and the *Embiotocidæ*, it is obvious that there are exceptions to the method of development characteristic of *Gambusia*.

Besides the very intricate net-work of capillary vessels which covers the follicles of the ovary of *Gambusia*, a large opening, Figs. 9, 10, 11, and 12 *mp*, Plate VIII, and Fig. 13, Plate IX, of a circular, though usually more or less oval, form makes its appearance in the wall of each one at or near the point of attachment of the vascular stalk by which they are supported. This opening appears to increase in size as the young fish develops; whether it is present during the earliest stages of the intrafollicular development of the embryo I do not know, as I did not have an opportunity to see those phases. A branch from the main nutritive vessel frequently lies near the margin of the opening, curving around it. Whether this opening serves the same purpose as the micropyle of ova provided with a membrane would appear very probable, as it is difficult to see in what other manner the milt, which is probably introduced into the abdominal cavity by the male, could reach the ovum through the wall of its follicle. The ovary itself seems to have no exterior investment, so that the follicles lie directly within the abdominal cavity, the young fishes upon the completion of their development rupture them and escape into the latter, and from thence through an abdominal pore into the outer world. The opening into the follicle licle may be named the *follicular pore*. Through it the cavity in which the embryo lies is brought in direct communication with the cavity of the abdomen, because it is extremely doubtful if the ovary as a whole is invested by a distinct membrane. If it is, its tenuity is extreme, since the follicles when gravid are readily separable as if entirely uncovered, or as if there were no external peritoneal investment reflected over them.

The nearly globular vitellus of the mature egg measures about a line in diameter. The germinal protoplasm probably occupies a peripheral position covering the nutritive or vitelline portion of the egg as a continuous envelope with strands of germinal matter running from it down

through the yelk substance. At the time of fertilization it is probable that the germinal matter is aggregated at one pole of the yelk. The latter in *Gambusia* is orange colored, and embedded between it and in the periblast superficially are a great number of refringent oil globules of small size.

The body of the young fish lies in a groove or furrow on the surface of the yelk at about the time the tail is beginning to bud out, as shown in Fig. 13, Plate IX, which represents the youngest stage of *Gambusia* which I have been able to observe. The somites or segments of muscle plates had been developed for some time, and the heart, brain, intestine, and organs of sense were well defined.

The next stage observed was that represented in Fig. 1, Plate VI, figured from the fresh embryo removed from its follicle.

The mouth is not yet well open and the pericardiac cavity seems to have its anterior or inferior wall supported by the end of the snout. The heart lies on the floor of this cavity on the yelk, with its venous end directed downward and forward. The vitelline net-work of vessels arise behind from the caudal vein, which bends down when it reaches the yelk, when it divides and sends a trunk forward along either side of the latter to join the rudimentary Cuvierian duct which runs down upon the yelk in the vicinity of the liver where the portal vein anastomoses with the latter.

The air bladder *ab*, Fig. 1, does not yet fill up the peritoneal cavity *pp*, and the liver *L* is quite large and lies on the left side. The intestine is not yet much bent or coiled upon itself.

The auditory vesicle and otoliths are well defined, and the eye and top of the head are pretty well pigmented.

The lateral line organs, or the *neuromasts* of R. Ramsay Wright, are present at this stage over each muscular segment, as shown by the small circles *nh* of Fig. 1. But at a later stage similar organs are found at the anterior border of the opercles, lodged in depressions of the skin as shown in section much enlarged in Fig. 20. These last-mentioned terminal sensory disks or *neuromasts* in the skin over the cheeks appear to derive their nerve supply from the great fifth pair.

The fins at this stage consist of the pectoral, dorsal, anal, and caudal; the ventral is not yet developed. Rays have commenced to form in the caudal; the others do not yet present any well-marked indications of rays, which only become well defined during the later stages shown in Figs. 2 and 3, when the ventral first appears as a papilliform rudiment on either side a little in front of the vent. No sexual differentiation of the anal fin was observed in any of the embryos taken from the follicles, and it is therefore inferred that such differentiation occurs during post-fœtal life.

The next stage observed is that represented in Fig. 2, which is drawn from a specimen hardened in chromic acid, and is consequently a surface view. The striking peculiarity which this specimen renders apparent is the prolongation upwards and forwards of a process of

the yelk-bag over the opercles at *py*. In other hardened specimens this pouch was observed to be prolonged upwards so as actually to meet its fellow of the opposite on the top of the head. In this way it happens that a sort of girdle is formed by the hollow cornua arising from the sides of the yelk-sac, which thus surround the head.

The next stage, Fig. 3, is from a living fœtus liberated from its follicle. In this specimen the scales were already developed, though the yelk was not yet absorbed, but was considerably diminished in amount. The heart still had its venous end directed downwards, gathering the blood from the net-work of superficial vitelline capillaries through a great median ventral vein, the same as in Fig. 1. In a cross-section, Fig. 15, from a specimen a little more advanced than that represented in Fig. 3, the dermal pouches in which the scales are developed are shown at *sp;* the section has also cut through the more advanced ventral at *vt* and the anal at *a*.

A remarkable characteristic of the embryos of *Gambusia* is to be noted in the fact that they do not develop continuous fin-folds, but, as shown in Figs. 1, 2, and 3, the vertical fins at once appear as distinct folds. This type is therefore not perfectly lophocercal or provided with a continuous eradiate dorso-ventral fin-fold such as is found in the embryos of *Gadus* of the same relative stage of development.

Chondrocranium.—The cartilaginous skull of *Gambusia* at about the stage represented in Fig. 3 is shown in detail in Fig. 21, Plate X. The brain-box has an incomplete roof; there is a cartilaginous bridge over the pineal region *T cr*, and one over the medulla oblangata *oc*. On its floor there is wide pituitary interval, as seen in Figs. 21 and 28, into which the hypophysis *Hy*, the infundibulum *In*, and optic nerve II, and crus *ch* project downward more or less decidedly. The chorda projects a considerable distance under the hind-brain, as may be inferred from Fig. 16, representing a longitudinal section of its anterior end, the vertebræ *vr*, *vr* being already differentiated with their intervertebral ligaments *l*, *l*, defined.

The auditory vesicle *Au* is covered externally by cartilage, and the orbit is limited above by an imperfect supraorbital curved cartilaginous bar, below by the pterygopalatine and hyomandibular bars. The nasal fossæ are limited behind by the cartilaginous orbito-nasal septum, below by the rostrum. The hyomandibular *Hm* is remarkably long and slender when embraced together with the symplectic *Sy*. Meckel's cartilage, *Mk*, is short; the glosso-hyal *G. Hy* is long; the hypo-hyal, *Hy*, nearly globular; the cerato-hyal, *C. hy*, wide and somewhat prolonged and joined to the hyomandibular by a short interhyal, *IH*. The branchiosteges *Brs* originate in perichondrial membrane, and have no cartilaginous rudiments. There are five branchial arches, I, II, III, IV, V, and detached suprabranchial nodules, *S. br*.

Behind the branchial arches, but more superficially, lies the cartilaginous coraco-scapular rudiment *Cor*, *Sc*, with the cartilaginous plate from which the actinosts are formed, abutting against it posteriorly.

The posterior branchial arches support clusters of teeth, which, in the sections studied by the writer, presented the forms represented in Figs. 26 and 27. A saccular organ, *df*, was developed from the deeper layer of the epidermis, in which the conical crown of the tooth, *d*, is first formed, as shown in Fig. 26, but with the progress of development the perichondrium *pch*, Fig. 27, which invests the cartilaginous branchial bar *Br*, forms a basal cushion, *s*, *s*, *s*, for each tooth, the conical crowns *d*, *d*, *d* being evidently articulated to the summits of these cushions, which give rise to the so-called cementum plates. It would thus appear that the crowns of the pharyngeal teeth, like the dermal denticles of certain forms, arose separately from the basal parts, which it is very clear develop later than the crowns in this instance, in intimate relation to the perichondrium investing the branchial bar, and therefore have a deeper origin than the crowns. The saccular organ, *df*, is developed from a more or less nearly solid diverticulum of the deep layer of the epidermis, which, in some cases, finally loses its connection with the latter, and becomes hollowed out inferiorly into a cap-like organ in which the germ of the crown appears.

The branchial filaments in the advanced embryo shown in Fig. 3 already have cartilaginous axes, *c*, as shown in Fig. 17 ; the base of the axis of the filament being furcate, and resting astride of the branchial vein *vb*, and not quite in contact with the branchial arch *bh* itself. These filaments are already pinnate and vascular.

The vertebral column.—The anterior part of this organ has already been described. The vertebræ are best differentiated anteriorly; in the tail the membrane in which the ossification of the centra occurs is apparent but not so strongly marked as anteriorly. The chorda bends upward but slightly at its hinder end, so that the urostyle is finally very short, as shown in Fig. 18.

The ribs are developed in cartilage as a single line of longitudinally compressed cells, as shown in Figs. 19 and 23 at *rb*. In the anterior thoracic region the heads of the ribs are elevated above the level of the chorda and are embedded in the fibro-cartilaginous rudiments *sk* of the neural arches, as shown in Fig. 23; posteriorly the ribs have their heads lowered more and more and assume a more ventral and intimate relation to the skeletogenous sheath of the chorda.

The fin-rays of the caudal fin in the most advanced fœtuses are already pretty well developed in membrane, beneath the epidermis; their relations to the mesoblast *me* internally and externally to the malpighian layer *sl* and epilthelium *ep* being shown in the cross-section represented in part in Fig. 24, and in Fig. 9 at *t*.

Visceral anatomy.—The way in which the fœtus is coiled up in the follicle is shown in Fig. 4, in which the process of the yelk-bag *py*, which extends upward over the opercles and to the top of the head, is also shown. In Fig. 9 a section through a follicle with the embryo in place and cut through at three different points is shown. This section also shows the open follicular pore *mp* with a thickened margin and the fol-

licular artery *fv* at the outer border of the thickened edge of the membrane.

The yelk *y*, liver *l*, intestine *i*, *i*, *i*, the air-bladder *ab*, the Wolffian ducts *Wd*, *Wd*, the aorta *ao*, chorda *ch*, muscles of the pectoral *pf*, &c., are also shown in Fig. 9. But in order to comprehend the visceral anatomy of the fœtal stages of *Gambusia*, Figs. 5, 6, 7, 23, and 25 are more satisfactory.

These sections will render it obvious once for all that in this form at least there is no connection whatever of the yelk with the intestine. That there is a wide space, *sc*, between the intestine posteriorly and the vitellus *y* is plainly shown in Figs. 5, 6, and 7.

The yelk also presents a well-marked periblastic layer, *yh*, in which the oil globules are embedded superficially. This periblastic stratum is thickest on the outer surface of the yelk and in the vicinity of vessels, but quite thin where it forms the floor of the abdominal cavity. In the cross-section, Fig. 5, the periblast sends up a median septum which divides the cruder yelk or deutoplasm into two moieties. Superficially the periblast has the vitelline vessels impressed into its surface, and in consequence of the fact that I have been unable to find a distinct cellular wall on their inner or periblastic sides I infer that the yelk is taken up from the periblast directly by the vessels. The cleavage cavity is persistent as in other Teleosts, and is apparent on either side of the vitellus in Fig. 9.

The heart, the details of which are shown in transverse section in Fig. 8, extends down into the anterior end of the yelk-sac, as shown in Figs. 6 and 7, having been first extended into the cleavage cavity, as indicated in Fig. 13. The most inferior chambers of the heart receive the venous blood, and all are thin walled except the ventricle *ve* and the bulbus aortæ *ba*, Fig. 6. The heart, as well as the liver and intestine, is more or less impressed into the surface of the yelk.

The œsophagus is somewhat bent upward posteriorly, from which extremity the air-bladder arises somewhat to one side. The pneumatic duct is open in the fœtus and is short, leading abruptly into the air-bladder *ab*, which is a depressed sac, the floor of which is very much thicker than the roof. The liver is a very massive organ relatively, and opens into the alimentary canal in the vicinity of its first turn. A large portal vessel passes from the liver outwards to the left, as shown in Fig. 5, and communicates with the vitelline system of vessels. What seems to represent a pancreas is seen in some sections adherent to the intestine, as shown in Fig. 6. In the posterior and upper part of the abdominal cavity, behind the intestinal coil, are placed the reproductive organs *o*, as indicated in Figs. 6 and 7; with greater magnification of that part of a cross-section the reproductive organ or genital folds have the appearance indicated at *o* in Fig. 25, which shows the organ in its indifferent stage, when it is quite impossible to tell whether the large nucleated cells embedded in it are going to give rise to ova or to spermatozoa. They lie on either side of the mesenteric suspensor of the intes-

tine; are, in fact, thickened ridge-like swellings of the sides of the mesentery.

The renal system lies almost wholly exterior to the abdominal peritoneum of the embryo, and is the only organ, with the partial exception of the air-bladder, which does so. The renal or Wolffian organ of *Gambusia* consists of a remarkably well-developed anterior mesonephric portion *pn*, Fig. 7, which is crowded up against the auditory vesicle posteriorly and richly supplied with blood-vessels. The pronephros was not observed, as the stages studied by me were already too far advanced, but the posterior part of the segmental duct was still essentially pronephric in character, as no segmental tubules opened into it. At the hinder aspect of the urinary vesicle *al* the segmental duct of the one side joined its fellow of the opposite side, and shortly after opens into the bladder, which has a distinct outlet, which lies in a line continuous with that of the segmental tubes when the latter are viewed from the side. In Fig. 23, *Pn*, a cross-section of the anterior mesonephric organ of *Gambusia* is shown, and in Fig. 25 the segmental or Wolffian ducts *Wd.* are shown in cross section through the region of the posterior part of the abdomen.

The brain.—A vertical longitudinal section of the brain of a fœtus of *Gambusia*, which has attained about the development of the one shown in Fig. 3, is shown in Fig. 28. The cerebellum *cer* is unusually wide antero-posteriorly, resembling in this respect the cerebellum of *Amiurus* of about the same age. The oral epithelium is shown in place at *oep*, and at *Hi* there is an involution which seems to represent the last vestige of the hypophysial pouch from which the hypophysis *Hy* has been developed, and from which that structure has become disconnected.

The *muscular system* presents nothing essentially different from that to be met with in other fish embryos. The so-called lateral dermal muscle *Dm*, Fig. 23, is distinguishable as a distinct layer of fibers external to the myotomes *m*, *m*, *m*, but it is remarkable that this muscle still shows the segmented condition seen in the latter, a feature which it does not share in common with the dermal muscles of higher animals. It is therefore seriously to be doubted if it has any very strong claim to be called a dermal muscle.

The courses of the fibers of the muscles of the body are shown in Fig. 7, which represents a longitudinal section considerably off of the median line.

The muscles of the pectoral develop as usual on either side of the coraco-scapular plate *cs*, Fig. 7, and are probably derived as in the Elasmobranchs from buds given off by the muscular segments above the rudiment of the girdle. It will be noticed, however, that there are no muscles developed around or below the yelk-sac, so that there are no recti-abdominales muscles yet formed, the only investment of the yelk being the outer epiblastic covering and the deeper mesoblastic one developed in connection with the vascular net-work which ultimately unites with the heart anteriorly.

Conclusion.—The foregoing account greatly expands and finally completes the history of the development, as far as my materials permit, of this remarkable form, preliminary notices of which I published in *Forest and Stream* in August, 1881, and in the *American Naturalist** for February, 1882. While this history is still far from complete, especially as respects the very early stages, we have at least cleared the ground and prepared the way for further investigations. A number of points which had been left undecided have been determined. These are the following:

1. That fertilization of the egg of *Gambusia* occurs within the ovarian follicle, the spermatic fluid being apparently introduced into the ovary or abdominal cavity by the male, which is provided with an intromittent organ consisting of the anal fin much modified, and that the spermatozoa find access to the egg through a wide opening in the follicle which answers to a micropyle, but which may be called the *follicular pore.*

2. That there is no evidence, as in the case of *Anableps* and the *Embiotocidæ*, that the ovarian follicles are ruptured until the development of the young embryos is approximately completed, since the most advanced fœtuses of *Gambusia* studied by me have the scales, fins, fin-rays, and cranium remarkably well developed, even before the yelk is all absorbed, as it is known that the young are born not a great while after the stage of development represented in Fig. 3 has been reached.

3. It is also known that little or no nutriment is derived from the parent, as in *Anableps* and the *Embiotocidæ;* or, in other words, that the embryo of *Gambusia* grows entirely at the expense of the material contained in the yelk-sac, and does not form villi upon the latter nor enlarge after the yelk has been absorbed as in *Anableps;* neither does the rectum or hind gut hypertrophy, nor do the fins expand and develop prolongations of the interradial membranes as in the *Embiotocidæ.*

4. As is the case with all viviparous forms, the number of embryos produced seems to be diminished in correlation with the protection which the young receive in consequence of their peculiarly complete development within the body of the parent. The embryos leave the parent as active little fishes about half an inch in length; in fact this fish begins an independent career as far developed as when the shad, cod, Spanish mackerel, catfish, and many other fishes are from three to six weeks old. By so much it has the advantage over those species in the struggle for existence in that it is ready to feed, to pursue its prey discriminately, as soon as it is born, while the other forms alluded to are comparatively helpless until some time after they are born; hence nature makes up in the fertility of such species for the advantages enjoyed by the viviparous ones, so that finally the chances of the survival of the two types, which differ so widely in their breeding habits, are about equal.

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* Structure and Ovarian Incubation of Gambusia patruelis, a top-minnow. Am. Nat., 1882, pp. 109–118.

VI.—Habits of Gambusia during the breeding season.

Mr. A. A. Duly has informed me that he has witnessed the act of copulation and the birth of the young of *Gambusia*. In coitus the male's head is turned in the direction of the tail of the female, the prolonged anal fin seeming to be thrust into the external opening of the ovarian duct or genital pore of the female, which lies just in advance of the anal fin.

The young when born are stated by Mr. Duly to be about three-eighths of an inch in length, and to be expelled in a single mass, consisting of eight to eleven young fishes at a single effort. This mass as soon as it escapes is seen to be composed of the infant Gambusias, which at once separate and swim away. No membranes seemed to be expelled together with the mass of young, so that it is probable that in this species as in *Anableps* and the *Embiotocidæ* the fœtuses rupture the follicles in which they were developed a short time before birth. I say a short time before birth, because our observations indicate that, unlike *Anableps* and *Micrometrus*, the development of *Gambusia* is essentially completed within the follicles, and no yelk-sac remains outwardly visible when the young are set free.

My informant also tells me that the parent fishes devoured their young as soon as they were born if they were not separated, by transferring one or the other at once to another aquarium. Fright seemed to hasten or precipitate the parturition, which Mr. Duly tells me actually took place under such circumstances. He also noticed that more than one brood seemed to be produced by the same parent consecutively and during the same season, and he has reason to think that more may have been produced, as his observations only extended over the latter part of summer with adults brought from Cherrystone, in August and September, which he kept in aquaria in the National Museum.

VII.—The viviparity of Fundulus.

On Plate XI, Figs. 29 and 30, I figure two views of another type of Cyprinodont embryos, viz, *Fundulus majalis*, also obtained at Cherrystone, Va., July 18, 1881. In this case a well-marked *zona* was developed investing the developing embryo. The oil drops were superficially embedded in the yelk the same as in *Gambusia*. A great network of vessels surrounded the yelk, as may be seen in both figures; these spread over the yelk from the two Cuvierian veins which pass out from the side of the body of the embryo just in front of the pectoral fin-folds, and are gathered inferiorly, as represented in Fig. 30, into a great median vein which is extended from the venous end of the heart.

A hood is probably formed at the sides of the head of this species the same as in *Gambusia*, as indicated by the vascular membrane at the sides of the head raised from contact with the yelk, as shown in Fig. 30.

The body cavity under the axis of the embryo is a deep oval sinus extending down a little distance into the substance of the yelk, as shown in Fig 29, behind the rudiments of the pectoral fins.

ON CERTAIN FEATURES OF THE DEVELOPMENT OF THE SALMON.

By JOHN A. RYDER.

So much has been written upon the anatomy and development of this fish by eminent authorities that I approach the subject with a certain hesitancy. The development of the skull has been elaborately worked out by W. Kitchen Parker. The skeleton of the adult has been figured in great detail by Bruch in a magnificent monograph, while the general development has been repeatedly discussed by investigators during the last century with more or less thoroughness. Notwithstanding this, it may be truly said that our knowledge of the exact details of some features of its development is still imperfect, even though such able embryologists as Œllacher, Balfour, His, Hoffmann, and Ziegler have devoted considerable attention to it and its allies within a period extending over scarcely more than the past decade.

The early stages of development have been investigated by Œllacher, His, and Ziegler, with such opportunities that can only be enjoyed by one who is near a locality where the spawning or oviposition of the adults is in progress. I can therefore add nothing to the information given us by those writers, but all that will concern us at present is the arrangement of the blood-vascular system at the time of hatching, some of the impairments which this system suffers when the young fishes are under the care of the fish-culturist, and the development of the fins.

The material used in this investigation consisted of recently-hatched embryos of the land-locked salmon, *Salmo salar*, var. *sebago*. I have carefully drawn a live specimen several times enlarged by the help of the camera lucida, as represented in Fig. 1, in order especially to show the arrangement of the vessels on the vitellus, the distribution of the rose-colored oil drops in the latter, and the vessels and venous sinus in the tail.

The mode of development and outgrowth of the fins is especially interesting, the more so since Professor Cope has recently reached the conclusion that many of the so-called "Ganoids" of the Palæozoic rocks seem really to be affiliated to a great and important order of existing fishes embraced by that author under the term *Isospondyli*, which includes the existing Salmonoids, Clupeoids, Hyodonts, Albulids, &c. As it therefore seems that the salmon belongs to a very ancient series of forms dating back phyletically to the Devonian, it may be well for us to examine into the development of the fins to see if that process would really give countenance to Professor Cope's views.

I. *The vertical fins.*—This set of fins is developed from a median fold extending from a vertical slightly behind the pectorals back over the end of the tail, thence forward on the ventral side to the posterior side

of the yelk-sac, the ventral part of the fold being interrupted only by the posterior part of the gut at *v*. Fig. 1. This fold at the time of hatching contains simple embryonic rays throughout its entire extent, these being indicated in Fig. 1 by the fine linear striation apparent for the whole length of the fold in the engraving. These embryonic rays, as they have been called by A. Agassiz, I will call *actinotrichia*, from their slender, unsegmented, hair-like appearance; they are developed from special cells of the mesoblast, which I have named *pterygoblasts* elsewhere. These actinotrichia exceed in number the permanent rays of the adult at least ten-fold. The latter are in fact in great part formed by the fusion of a number of these actinotrichia lying side by side.

The extent to which actinotrichia are developed in the median fin-fold at the time of hatching, however, varies very greatly in different genera. In the recently hatched salmon, which passes through a prolonged period of incubation, these rudiments of the future permanent rays are very numerous, far more so than is the case with most other forms at the time the embryo escapes from the egg. In the Spanish mackerel and in *Gadus* the actinotrichia are not well defined until some time after hatching, and then only in the posterior end of the median tail-fold and in the pectoral fin-fold. As a rule, actinotrichia, (horny-fibers of Balfour), appear first in the anterior paired fins; this is the case in the salmon, in which these primitive rays are well marked in the pectoral about the time the ventral fin-folds *vt* become well defined.

As urged in my paper "On the origin of heterocercy," the presence of actinotrichia throughout the whole extent of the fin-folds of the embryos of the salmon is an illustration of the Hæckelian principle, viz, that the ontogeny of a form is usually an epitome of the phylogeny of the same. The persistence of the pneumatic duct and the presence of adipose fins are also to be considered in this connection, since both are archaic characters, the first especially.

The permanent dorsal rays of the salmon are formed from the actinotrichia developed in the anterior part of the median fold *d*, *fig.* 1, towards which radial muscles are shoved out at an early stage, as shown by the evenly stippled intervals at the base of this part of the fold. The fold in the interval between the dorsal and soft dorsal atrophies with the further growth of the young fish, the actinotrichia of this interval also disappearing with the fold.

The next portion *sd* of the median vertical fold which is perceptibly widened, gives rise to the soft dorsal or "adipose fin." The actinotrichia of this fin never pass beyond their embryonic condition, so that it is said by the comparative anatomists to contain horny fibers. The whole of the Plectospondyli except the *Characinidæ* have lost their adipose fins, and thus have but one dorsal remaining. The herrings and salmonoids or *Isospondyli* would therefore seem to stand in an ancestral relation to the carps, suckers, and minnows, or *Plectospondyli*. It is at

any rate obvious that the protopterygian condition of the adipose fin is a less specialized and more archaic one than that of its complete atrophy.

The interval between the soft dorsal and the caudal is in part atrophied. The posterior part of this interval, however, gives rise to the short accessory rays of the dorsal edge of the caudal.

The truly dorsal part of the median fin-fold of the embryo salmon ends at the notch *n*, towards which the urochord, later the urostyle, is directed. At this point the proximal ends of the dorsal and ventral actinotrichia embedded in the fold converge in a penniform manner. The actinotrichia below the notch *n* and extending out into the caudal lobe *cd* give rise to the prolonged caudal rays, while those in the ventral part of the fold just in front of the caudal lobe give rise to the inferior accessory caudal rays.

The fold in the interval between the caudal and anal *a* atrophies, together with its contained actinotrichia, while those in the widened anal part of the fold *a* as far as the vent *v* give rise to the permanent rays of the anal, into which the muscles of the fin grow at an early stage or at about the same time that those of the dorsal are developed.

The prëanal part of the fold *pa* in front of the vent, together with its contained actinotrichia, atrophies entirely during further growth and development.

It is thus shown by the development of the salmon that the most primitive type of distribution of the vertical fins of osseous fishes was a continuous one, because of the development of a continuous series of actinotrichia or primitive rays, and that the forms which now exist and most nearly realize this distribution of the rays of the vertical fins are the Dipnoans, in which the rays are also scarcely more than well-developed actinotrichia, several of which, taken in succession, are homologous with a single ray of an adult Teleost.

The Dipnoans present many other embryonic characters which seem to be partially paralleled by what is transitory in the embryo salmon. When we shall know more of the embryology of *Ceratodus* through the efforts of Mr. Caldwell, who has succeeded in obtaining its ova, further comparisons may be instituted between the ordinary Teleostean embryo and that of the singularly specialized mud-fishes.*

Some of the oldest "Ganoids" had the vertebral axis persistently chordal, unmodified anteriorly, and with an extended series of fins, in these respects paralleling somewhat the condition which is transient in the embryo salmon. These seem to me to be good reasons for accepting Professor Cope's views as to the affiliation of certain of the Palaeozoic fishes with the existing Isospondyli, in the absence, as the latter

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* It is important to examine the fin-folds of the tails of the larvæ of such Amphibians as *Pseudis* and *Dactylethra* to determine whether or not actinotrichia are present. Should these earliest representatives of fin-rays be found in any of the Amphibia the abrupt hiatus now existing between the Dipnoans and the latter would, in a great measure, be bridged.

authority states, of all other characters, except the scales, adequate to separate the two.

II. *Paired fins.*—The paired fins of the salmon develop at wide intervals from each other, that is, the ventral pair is separated from the pectoral by an interval of not less than sixteen muscular segments. In *Lophius* the number of muscular segments opposite the interval between the pectorals and ventrals are reduced to four, according to the figures given by A. Agassiz. In other types this interval between the rudiments of the paired fins of the embryo is still further reduced, as for example in *Trachinus vipera** and in *Motella mustela*† in which, according to Brook, but two muscular segments intervene between the earliest rudiments of the pectoral and pelvic fins, so that in these types it may be said that the paired fins develope from almost continuous rudiments. These and *Lophius* seem to develop the rudiments of the paired fins almost synchronously, which is far from being the case with the larvæ of the Physostomous orders, *Ginglymodi*, *Glaniostomi*, *Nematognathi*, *Plectospondyli*, *Isospondyli*, *Haplomi*, and *Enchelycephali*,‡ in which the ventral pair of fins appears late, often after the pectoral is well developed and in active functional use. In most, if not in all, the larvæ of Physostomous species of Actinopteri, as limited by Cope, the ventral pair of fins is later in appearing than the pectoral; on the other hand in the Percomorph and Pediculate divisions of the Physoclistous Actinopteri it seems that in many species the pectoral and ventral limbs appear almost synchronously, the pectoral usually a little more developed than the ventral pair, and separated serially by only two to four myotomes, while this interval in the Physostomous forms may embrace over sixteen muscular segments.

Finally it may be said that the ventral pair of limbs is almost always undergo shifting or translocation forwards in the Physoclistous groups mentioned. The researches of Mr. Brook, cited above, afford additional evidence of the truth of the principle laid down by me in a preliminary notice§ recently published.

The Physoclistous genera, *Gadus*, *Cybium* (*Scomberomorus*) and *Parephippus* seem to be exceptions to the rule spoken of above, as holding in the development of some forms. How far the rule held in the development of the Palaeozoic fishes with ganoid scales and ventral or abdominal pelvic fins, we, of course, now have no means of knowing. These, with the exception of *Dorypterus* and *Blochius*, seem to have had

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*Preliminary account of the development of the Lesser Weever-fish Trachinus vipera, by George Brook, F. L. S., Journ. Linn. Soc., xviii, pp. 274–291, pls. 4, 1884.

†On some points in the development of Motella mustela, Linn., by George Brook, F. L. S., Journ. Linn. Soc., xviii, pp. 299–307, pls. 3, 1885.

‡The eels are of course permanently without ventrals; the youngest obtainable larvæ of Anguillidæ and the Leptocephalid stages of marine eels show no traces of ventral limb-folds; these forms are in fact permanently apodal.

§On the Translocation forwards of the Rudiments of the Pelvic Fins in the Embryos of Physoclist Fishes, Am. Naturalist, 1885, pp. 315–317.

the pelvic fin not displaced forward, but normal in position, as in the majority of existing Physostomous Actinopteri.

The belated development of the pelvic fins of some of the *Isospondyli* and *Haplomi* is quite remarkable; in fact, the pectoral in these forms may have the permanent rays pretty well developed before the ventral fin-fold has done much more than begun to develop. The ventral fin-fold, however, in those forms in which it appears synchronously with the pectoral is at first always the smallest, thus showing the effects of an inherited tendency to retard the development of the pelvic fins.

In the salmon the pectoral is functionally developed with well defined actinotrichia lying beneath the investing epidermis, as shown in Fig. 1, by the time the ventral is appearing as a flat, immobile lobe without developed actinotrichia, behind and above the yelk-bag.

III. *The embryonic blood vascular system.*—In the embryo salmon this attains great importance apparently in consequence of the presence of a voluminous yelk which is absorbed by a system of vitelline vessels. A large median aortic trunk *ao*, Fig. 3, is developed under the notochord *ch*, Fig. 4. It is formed from two convergent suprabranchial arteries anteriorly, which receive their blood from the branchial trunks coming from the gills. The aorta extends backward, giving off "intercostals" and intersegmental branches *s* along either side and terminates under and at the end of the urochord. A recurrent vessel then bends down from it and divides into several loops which converge in the caudal venous sinus *sc*, Fig. 3, incorrectly referred to as a "caudal heart" by some writers, as it exhibits no independent pulsations of its own.

From the caudal sinus the caudal vein or cava arises and passes forward towards the body-cavity, where it divides anteriorly into the paired cardinal veins *cv*, Fig. 3. These pass forward to the venous sinus of the heart formed by the Cuvierian ducts into which they empty their contents. The heart lies behind and below the branchial frame-work, and forces only venous blood through the gills. Its anterior chamber or bulbus aortæ is prolonged forward into a truncus arteriosus, which gives off a pair of vessels to each pair of gills. These vessels, after breaking up into a plexus of capillaries, send the arterialized blood through another set of branchial vessels which join a pair of longitudinal trunks, of which the radices aortæ are prolongations posteriorly and the carotids anteriorly. The venous blood from the head is carried back to the heart by way of a pair of jugular veins or anterior cardinals to the venous sinus. The foregoing describes in outline the systemic circulation proper, exclusive of the great portal system, to which the network covering the yelk-bag also properly belongs.

The portal system of the young salmon with the yelk-bag still attached may be said to comprise no less than three successive sets of capillaries. The first of these arise from the caudal and cardinal veins *cv*, and pass from above downward on either side of the intestine to join and fill with blood a large azygous or median subintestinal vein,

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si, Fig. 3. This vessel passes forward under and into the liver *L*, where it again breaks up into a plexus of smaller vessels; these then again blend into larger trunks, as shown at *pv*, in Fig. 4, which emerge from the liver to again break up into the capillary net-work *cc*, Fig. 3, which is still better shown in Fig. 1, on the surface of the yelk-bag. This vitelline net-work then joins the vitelline veins *vv* and *vv'*, which blend into a common trunk before joining the venous end of the heart. It will thus be seen that we have no less than five capillary systems in the young salmon, as shown in Fig. 1, if we reckon those of the portal system together with those belonging to the systemic system of vessels. These in their order are: (1) The branchial, (2) the systemic, (3) the intestinal, (4) the hepatic, and (5) the vitelline capillaries.

What the subsequent history of the third and fourth sets may be I have not made out, but the fifth or vitelline set has only a temporary existence, remaining only as long as there is yelk in the yelk-bag. As the yelk is absorbed this system disappears, when the vitelline veins *vv* and *vv'* become portal veins; that is, they carry all of the blood which passes through the viscera back to the heart.

A study of sections of the yelk-sac of the salmon leads to the following conclusions: A well-marked periblastic stratum of plasma, *p*, Fig. 4, invests the yelk. Beneath the periblast lie the oil-drops *o*, *o*, which are largest at the upper part of the yelk, the greater buoyancy of these larger, superior oil globules tends to keep the young fish buoyed up, and functions much in the same way that an air-bladder would, a structure which, by the way, is not yet functional in the young salmon at this stage of growth. In the earlier stages these larger oil-drops, which lie just under the blastodisk or germinal mass, by their buoyancy constantly keep the germ rotated or turned toward the top of the egg.

External to the periblastic layer of the yelk comes the vascular net-work of capillaries, the walls of which are formed, apparently, by a thin sheet of splanchnic mesoblast *vm*, which invests the yelk but which has grown down over the latter at a later period, possibly, than the thin epidermic or epiblastic investment *ep*, Fig. 4. This vascular net-work is obviously the apparatus by means of which the yelk is absorbed superficially from the external plasmodium or periblast of the yelk, a stratum, which, as is well known, contains scattered free nuclei.

The epidermis or epiblast of the young salmon is remarkable amongst fish embryos for the peculiar goblet-shaped cells which are found distributed over almost the entire surface of the embryo. These are shown in a section of the epidermis in Fig. 5, much enlarged. Their function is apparently to secrete a mucilaginous substance for the purpose of protecting the skin of the embryo.

IV. *Diseases or abnormalities which involve the yelk-sac and vitelline*

circulation of salmon embryos.—A discussion of some of the pathological phenomena observed while salmon embryos are under the care of the fish-culturist seem to me to be in place here.

Shortly after hatching many of the young fish in the hatching troughs sometimes show whitish spots on the yelk-sac. If examined under the microscope it is plain that these spots consist of coagulated or dead yelk material. Very often the capillaries in the vicinity of these spots are found to be occluded and filled with clots of blood, as if the vessels had been bruised. In other cases it is found that the capillaries of the liver are occluded so that that organ, which is visible on the left side of the embryo through the integument, assumes a whitish, abnormal color. Closer examination reveals the fact that the blood no longer circulates through the liver, and that the tissues of the organ are practically dead, as indicated by the white color which they assume. These conditions lead to the death of the affected embryos in great numbers. The causes which seem productive of such abnormalities have not been determined with certainty, but it would seem probable that blows or knocks received by the sac from careless handling or the violent and too rapid flow of water over the young fish, so as to carry them violently against fixed objects in the trough, are probably very hurtful and productive of the changes noted.

Still other abnormal changes in the yelk-sac may be noticed here. The most serious is that characterized by the distension of the epiblastic covering of the sac with fluid so that it is lifted up from contact with the yelk more or less extensively. Usually, this distension only affects the posterior extremity of the sac, but occasionally specimens are observed in which there is a space all round the yelk between the latter and the epiblastic sac. Sometimes free-blood corpuscles which have escaped from ruptured vessels are found floating about in the fluid contained in the cavity described. At other times, an extension of the back part of the yelk proper may be prolonged backward into the outer sac, which may become constricted so as to embrace part of the yelk. As the anterior part of the yelk is then absorbed, the posterior constricted part is finally left hanging to the abdomen by a sort of pedicle formed by the outer sack. This finally drops off and the young fish survives. The spot where the stalk breaks off on the under side of the embryo heals up and the young fish seems none the worse for having lost part of its yelk, except that it has probably not grown quite so large or so rapidly as its more fortunate fellows.

The plate illustrating the foregoing article is number XII of the present volume.

ON THE ETHEOSTOMA VARIATUM OF KIRTLAND.

By DAVID S. JORDAN.

In the Boston Journal of Natural History 1840, pp. 274–276, Dr. Kirtland has described two species of Darters, under the names of *Etheostoma variata* and *Etheostoma maculata*. The second of these has been till lately known only from specimens in the National Museum, collected by Dr. Kirtland and Professor Baird in the original locality. Lately, on comparison of these specimens with others from Tennessee, Professor Gilbert has recognized the identity of *Etheostoma maculata* with the *Pœcilichthys sanguifluus* of Cope.

The *Etheostoma variata* has been less fortunate. Kirtland himself regarded it as identical with the later-described *Etheostoma cœrulea* of Storer, and under the name of *Pœcilichthys variatus*, Agassiz made the latter species the type of his genus *Pœcilichthys*. Putnam and Vaillant have correctly considered the *Etheostoma variata* as different from the *Pœcilichthys cœruleus*, but they have given no explanation of the grounds of their opinion.

In my earlier papers I have adopted Dr. Kirtland's view that the *Etheostoma variata* is the same as *Pœcilichthys cœruleus*. The resemblance in color of the two seemed to support this opinion, and the discrepancies in the description and figure were supposed to be due to inaccuracies on Dr. Kirtland's part.

In the Synopsis of the Fishes of North America, p. 503, Professor Gilbert and myself have adopted the view that Dr. Kirtland's figure and description were based on a specimen of *Hadropterus peltatus*, Stauffer, to which the coloration of *Pœcilichthys cœruleus* had been ascribed.

I have recently received two specimens of a Darter, taken in the White Water River at Brookville, Indiana, by Amos W. Butler. The larger of these, 3⅓ inches long, an adult male, agrees very closely with Dr. Kirtland's description of *Etheostoma variatum*, and is evidently the species which Dr. Kirtland had in mind.

It is a species previously unknown to me (except from two discolored and ill-preserved specimens—the types of *Hadropterus tessellatus*), and its rediscovery forms an important addition to our knowledge of these fishes.

The following is the synonymy of the species, with a description of my largest specimen:

Hadropterus variatus.

Etheostoma variatum, Kirtland, Zool. Ohio, 1838, 168, 192; Kirtland, Boston Journ. Nat. Hist., iii, 1840, 274. (Mahoning R.)

Hadropterus variatus, Putnam, Bull. Mus. Comp. Zool. 1, 1863, 4. (Name only.)

Beleosoma variatum, Vaillant, Recherches sur les Poiss., *Etheostomatidæ*, 1874, 84. (Locality unknown.)

Alvordius variatus, Jordan and Gilbert, Syn. Fish. N. A., 1883, 503. (In part confused with *Hadropterus peltatus*, Stauffer.)

Etheostoma notatum, Agassiz, MSS., 1850, fide Putnam. (No description.)

Hadropterus tessellatus, Jordan, Bull. U. S. Nat. Mus., x, 7, 1877. (Allegheny R.; young specimens discolored.)

Nanostoma tessellatum, Jordan and Gilbert, Syn. Fish. N. A., 1883, 511. (Dorsal spines given as "x," not xiii, by misprint.)

Head $3\frac{4}{5}$ times in length ($4\frac{2}{5}$ to base of caudal). Depth, $4\frac{4}{5}$ ($5\frac{1}{2}$). D. XIII–13; A. II, 9. Scales 8–51–9. Length, $3\frac{1}{3}$ inches.

Body moderately elongated, not much compressed, the back somewhat arched. Head short and thick, the snout short and blunt, and the profile above the eyes strongly decurved; profile a little depressed at the nape. Eyes large, not very close together, slightly longer than snout, $3\frac{3}{4}$ in head.

Mouth small, low, subhorizontal, the lower jaw included; teeth small, subequal, bluntish, in rather broad bands; teeth on vomer. Premaxillary not protractile; maxillary reaching front of eye, 4 in head. Top of head extremely rugose, the wrinkles evident through the skin, and radiating irregularly from behind the eye. Parietal region rather broad and depressed, as in other species of *Hadropterus*. Preopercle entire. Opercle with a rather sharp spine. Gill membranes somewhat broadly united, but meeting at a rather acute angle.

Head naked, except for one to three scales on the upper part of the opercle. Scales of body rather large, ctenoid. Lateral line complete. Nape covered with small scales; breast loosely scaled; belly covered with ordinary scales similar to those on the sides. No enlarged ventral plates.

Fins all very large. Dorsal fins slightly joined; anal fin large, but lower than the soft dorsal, and somewhat shorter. Pectorals reaching front of anal. Second anal spine longer than first; both of moderate size. Longest dorsal spine $2\frac{4}{5}$ in head. Longest soft ray $1\frac{1}{5}$. Caudal subtruncate, its longest ray $1\frac{1}{2}$ in head. Longest ray of anal $1\frac{3}{5}$. Pectoral a little longer than head; ventral a little shorter.

Color of large male specimen dusky greenish above, the head similar, the centers of the scales darker, and the whole body covered with fine dark points visible with a lens. Belly and sides of the body from anal fin forward and as high up as the level of the scapula of a bright yellow-orange. Posterior parts of the body with five vertical zones of bright orange, these about half as broad as the dark greenish interspaces; first zone opposite the interspace between the dorsals, and extending downward to front of anal; the last two on caudal peduncle. A vague, dusky area on base of caudal; a dusky shade across nape in front of dorsal. Head nearly plain, with some dark specks and some dashes of orange. Breast with light orange shades.

First dorsal with a broad median band of blue-black; a paler stripe

below it and above it; the base of the fin with dark interspinal spots, and the edge of the fin again blackish. Second dorsal blue-black dashed with orange toward the base; caudal blackish, rather darker at base; anal blue-black, with orange-yellow at the base; pectoral blackish, with orange cross shades; ventrals blue-black, with some edgings of orange.

The young example is similarly marked, but has less dusky shading, the fins being mostly pale.

These specimens were obtained in a hydraulic canal above Brookville, Indiana, by Mr. Amos W. Butler, April 25, 1885.

INDIANA UNIVERSITY, *April* 29, 1885.

ON THE OCCURRENCE OF HADROPTERUS AURANTIACUS (COPE), IN THE FRENCH BROAD RIVER, NORTH CAROLINA.

By **TARLETON H. BEAN,**
Curator of the Department of Fishes.

The National Museum has just received from Dr. J. A. Watson, of Asheville, N. C., a fine specimen of the above species.

(Accession No. 15967; catalogue No. 37175.)

The length of the example is 103 millimeters; the length to end of lateral line is 88 millimeters. The form is elongate. The caudal peduncle is somewhat deep, its depth equaling about one-half the length of the head. The snout is somewhat abruptly curved, and the lower jaw is included. The back is not conspicuously elevated. The outline from the interorbital space to the origin of the dorsal forms almost a straight line. The head is slightly compressed anteriorly; its greatest length is contained about $4\frac{1}{3}$ times in the length to end of lateral line, and the greatest depth of the body about $5\frac{1}{3}$ times. The eye is one-fourth as long as the head, and equal in length to the snout. The width of the interobital space is contained 5 times in the length of the head. The upper jaw is slightly longer than the eye. Strong teeth in the jaws. A few teeth on the head of the vomer. The maxillary reaches a little beyond the vertical through the anterior margin of the orbit. Cheeks and operculum with small scales in numerous rows. Preopercle entire. Gill membranes very narrowly united. Opercular spine feeble. Gular region naked. Scales of body very small, ctenoid. The belly is covered with ordinary scales. Scales at the nape very small and numerous. Lateral line complete, nearly straight, only slightly elevated over the anterior half of the pectoral, following a little above the median line of the body.

The dorsal fins are separated by a very narrow interspace. The longest dorsal spine is one-half the length of the head. The soft dorsal is higher than the spinous dorsal, its longest ray being nearly two-thirds as long as the head. The caudal seems to have been nearly truncate

or very slightly rounded. The longest ray of the anal is about equal to the length of the head without the snout, and exceeds the length of the longest dorsal ray. The anal spines are subequal in length, the second one being nearly one-half as long as the head. The pectoral is nearly as long as the head, slightly longer than the distance of its tip from the origin of the anal; its length is contained about $4\frac{3}{4}$ times in the total length to end of scales. The ventral equals the pectoral in length, and extends farther back. D. XV, 14: A. II, 11; Sc. 14–86 (tubes)—24.

A narrow, light area along base of spinous dorsal, above which the fin is dark. Snout and iris very dark and humeral region and the region through which the lateral line passes with a dark pseudo stripe somewhat intensified at both ends, and almost forming bands on the body. The greatest width of this dark stripe somewhat exceeds the length of the eye. Base and upper half of pectoral orange. Traces of orange on cheeks and nape. The whole of lower portion of body largely orange. Ventrals, and all but the basal portion of the anal, dark; the ventrals with a bluish tinge. A pearly blotch on the lower portion of the pectoral. Soft dorsal and caudal more or less suffused with orange.

ON THE IDENTITY OF COTTUS MACULATUS, FISCHER, WITH COTTUS BUBALIS, EUPHRASEN.

By **TARLETON H. BEAN,**

Curator of the Department of Fishes.

In a recent extract from the annals of the Scientific Association of Hamburg,* Dr. J. G. Fischer has described and figured a species of *Cottus* from Barbadoes. The anomaly of finding a species of this genus within the tropics induced me to examine the description very carefully, to ascertain, if possible, the source of Dr. Fischer's specimen. There is no reasonable doubt that the type of his new species is the common Father-lasher of Europe, and it is a source of wonder that the species should have been misinterpreted. After a study of our examples of *Cottus bubalis* from Bergen and Christiania, in Norway, and Leeds, England, I have no hesitation in stating that they agree perfectly with the description and figure of *Cottus maculatus.*

In some unknown way the locality of Dr. Fischer's specimen has been incorrectly given, and thus the describer of the supposed new species has been completely misled.

The differential characters claimed by Dr. Fischer for *Cottus maculatus* do not serve at all to separate his species from *C. bubalis.* The arrangement and number of the spines on the preoperculum are precisely the same in our examples of *Cottus bubalis* as represented in the figure

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*Jahrbuch der wissenschaftlichen Anstalten zu Hamburg, ii, pp. 78, 79, taf. ii, fig. 8.

of *C. maculatus.* The ventral and the pectoral are not longer in our specimens than they are made to appear in the figure of the alleged new species.

The notion seems to have got abroad among some of the European ichthyologists that North America is a comparatively benighted and barbarous country, whose natural history is still in its infancy; it is perhaps owing to this impression that we are startled by information concerning the supposed occurrence of *Cottus* within the tropics, and of a species of *Platycephalus* * in the Potomac River.

Our common little *Cottus æneus* of Mitchill also has been redescribed, from a New York specimen, under the name of *Cottus* (*Acanthocottus*) *anceps.*†

As a general rule it will be safe to intrust the novelties of fish distribution in our country to its resident ichthyologists

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DESCRIPTION OF A NEW CRUSTACEAN ALLIED TO HOMARUS AND NEPHROPS.

By SIDNEY I. SMITH.

Any additions to the small number of known types of existing Homaridæ are of special interest on account of the relations of the group to the Astacidæ and to several fossil forms, and for this reason it seems desirable to give a special notice of the following species recently taken in the Caribbean sea by the Fish Commission steamer Albatross.

Eunephrops, gen. nov.

The species for which this generic name is proposed agrees with *Homarus* and differs from *Nephrops* and *Nephropsis* in the number and arrangement of the branchiæ, and in the evenly swollen branchial regions; it agrees with *Nephrops* and *Homarus* and differs from *Nephropsis* in possessing antennal scales and well-developed eyes; it agrees with *Nephropsis* and differs from *Homarus* and *Nephrops* in having very large antennal spines, and in being without any spine on the second segment of the peduncle of the antenna; and it agrees with *Nephrops* and differs from *Homarus* and *Nephropsis* in having slender and carinated chelæ.

Eunephrops Bairdii, sp. nov.

Female.—The carapax is nearly as broad as high, and the branchial regions and the dorsum, except in front, are evenly convex and rounded. The cervical suture is conspicuous and very deep, extends round beneath the narrow lateral lobe of the gastric region and joins the middle

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* *Platycephalus americanus*, Sauvage, Nouv. Archiv. Mus. (2), i, 148, pl. ii, f. 3 (head only). Potomac River.

† *Cottus* (*Acanthocottus*) *anceps*, Sauvage, Nouv. Archiv. Mus. Hist. Nat., Paris (2), i, 1878, p. 145, pl. i, f. xiii.

of a conspicuous regularly semicircular suture limiting the hepatic region below and behind. The inferior edge of the rostrum is sharp and slightly roughened but not distinctly dentate. From the sides of the rostrum two low rounded carinæ extend back a little way upon the gastric region, and are each armed with two spines somewhat smaller than the lateral spines of the rostrum, while much farther back, upon the posterior margin of the cervical suture, there is a pair of similar subdorsal spines much nearer together. The anterior margin projects either side in a great vertically compressed dentiform spine reaching in an acute point as far forward as the eyes, and recalling similar spines in some of the Crangonidæ. Just back of the base of the antennal spine there is a small spine on the hepatic region, and between this and the posterior subdorsal spine of the gastric region, and back of the orbit, there is a similar spine. The carapax is everywhere roughened with minute tubercles between which the surface is beset with very short hairs.

The eyes, though not quite as large, are nearly like those of *Nephrops Norvegicus*, being vertically compressed, reniform, and black.

The antennulæ are like those of *Nephrops Norvegicus*. The general form and proportions of the bodies of the segments of the peduncle of the antennæ are almost exactly as in *Nephrops Norvegicus*, but the second segment is evenly convex externally and without any trace of a tooth or spine at the base of the very small antennal scale, which is very little more than half as long as the fourth segment, about half as wide as long, oblong-ovate, with a minute tooth at the tip and with the inner edge ciliated. The flagellum is considerably longer than the body of the animal and very nearly as in *Nephrops Norvegicus*.

The oral appendages agree very closely in every detail with those of *Nephrops Norvegicus*, except that there is a well-developed podobranchia, fully as large as in *Homarus Americanus*, at the base of the first gnathopod.

In the single specimen seen the right cheliped is in process of reproduction and very rudimentary. The left cheliped agrees in general form very closely with the more slender of the chelipeds of *Nephrops Norvegicus:* the inferior and superior edges of the merus, though roughened with somewhat spiniform granules, bear only one real spine each and that at the distal end; the spines of the carpus are slightly fewer, but arranged nearly as in *Nephrops Norvegicus;* the chela itself is very slightly broader than in *Nephrops Norvegicus*, the spines of the carinæ are a little less prominent, though the carinæ are spinulose or minutely tuberculose nearly to the tips of the digits, and the spaces between the carinæ are thickly tuberculose and not pubescent. The remaining peræopods are very nearly as in *Nephrops Norvegicus*.

The pleon is in general very much like that of *Nephrops Norvegicus*, but the whole dorsum is pubescent, and the second, third, and fourth somites have only an inconspicuous, transverse, dorsally interrupted

and densely pubescent sulcus in place of the much broader and conspicuous sulci upon all the somites of *Nephrops Norvegicus*. The depressions on the bases of the pleura are deeper than in *Nephrops Norvegicus*, and the inferior angles are more obtuse, and not distinctly hooked, as in that species. The second to the fifth pleopods are smaller and their lamellæ much narrower than in the *Homarus Americanus* or the male of *Nephrops Norvegicus*. [I have had no female *Nephrops* for comparison.]

Measurements in millimeters.

Length from tip of rostrum to tip of telson	142.0
Length of carapax, including rostrum	69.5
Length of rostrum	24.3
Length of rostrum in front of spines	13.0
Breadth between tips of antennal spines	21.5
Greatest breadth, at branchial regions	25.0
Height of carapax	26.0
Length of eye-stalk and eye	6.0
Greatest diameter of eye	7.0
Length of antennal scale	4.1
Breadth of antennal scale	2.0
Length of left cheliped	112.0
Length of merus	32.0
Length of carpus	22.0
Length of chela	54.0
Breadth of chela	12.5
Length of dactylus	24.0
Length of second peræopod	69.0
Length of merus	23.0
Length of carpus	10.5
Length of chela	18.5
Breadth of chela	3.0
Length of dactylus	6.0
Length of third peræopod	65.0
Length of merus	19.5
Length of carpus	9.6
Length of chela	20.5
Breadth of chela	2.8
Length of dactylus	6.0
Length of fourth peræopod	67.0
Length of propodus	15.6
Length of dactylus	8.7
Length of fifth peræopod	58.0
Length of propodus	15.0
Length of dactylus	7.0
Length of sixth somite of pleon	13.0
Length of telson	16.0
Breadth of telson	13.3
Length of inner lamella of uropod	14.0
Breadth of inner lamella of uropod	13.3
Length of outer lamella of uropod	19.0
Breadth of outer lamella of uropod	14.0

Station 2143, March 23, 1884; Gulf of Darien; north latitude 9° 30′ 45″, west longitude 76° 25′ 30″; 155 fathoms, green mud. One female (6939).

NEW HAVEN, CONN., *April* 29, 1885.

ON SOME GENERA AND SPECIES OF PENÆIDÆ, MOSTLY FROM RECENT DREDGINGS OF THE UNITED STATES FISH COMMISSION.

By SIDNEY I. SMITH.

Penæus Fabricius (restricted).

Unfortunately I have not been able to examine either of the species referred to the genus by Fabricius, but in *P. carimonte*, *canaliculatus*, *Brasiliensis*, *semisulcatus*, *setiferus*, and *stylirostris* the antennular flagella are very short; the distal segment of the mandibular palpus is much larger than the proximal, very broad, and not prolonged into a narrow tip; the endognath of the first maxilla is greatly elongated and segmented; the endopod of the maxilliped is slender and composed of four segments, and the exopod is lamellar and unsegmented; both pairs of gnathopods have well-developed epipods and large exopods; all the peræopods have small exopods, but only the first, second, and third are furnished with epipods; there is a well-developed pleurobranchia on the fourteenth somite. The number and arrangement of the branchiæ and epipods are the same for all these species, and is indicated in the following formula:

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods	1	1	1	1	1	1	0	0	(6)
Podobranchiæ	0	1	0	0	0	0	0	0	1
Arthrobranchiæ	r.	2	2	2	2	2	1	0	11 + r.
Pleurobranchiæ	0	0	1	1	1	1	1	1	6
									18 + r. + (6)

These species also agree in having well-developed antennal and hepatic spines and conspicuous antennal and hepatic sulci; but these characters are not regarded as of generic value.

Parapenæus, gen. nov.

The species referred to the genus here proposed are at once distinguished from the species of *Penæus* proper in having the endognath of the first maxilla short and unsegmented, the second gnathopod without an epipod, and the fourteenth somite (posterior somite of the peræon) wholly without branchiæ. The species examined further agree in having none of the sulci of the carapax conspicuous except the cervical, and in having the antennular flagella shorter than the carapax. In the first three species here referred to the genus the mandibular palpi

are as in the typical species of *Penæus*, there are no exopods at the bases of any of the peræopods, and the branchio-epipodal formula is—

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods	1	1	0	1	1	1	0	0	(5)
Podobranchiæ	0	1	0	0	0	0	0	0	1
Arthrobranchiæ	r.	2	2	2	2	2	1	0	11+r.
Pleurobranchiæ	0	0	1	1	1	1	1	0	5
									17+r.+(5)

In *P. constrictus* and a Japanese species here doubtfully referred to the *P. barbatus* (De Haan) the distal segment of the mandibular palpus is slightly elongated and narrowed distally; there are very small narrow lamellar exopods at the bases of all the peræopods; and there is no pleurobranchia on the thirteenth somite, the branchio-epipodal formula being—

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods	1	1	0	1	1	1	0	0	(5)
Podobranchiæ	0	1	0	0	0	0	0	0	1
Arthrobranchiæ	0	2	2	2	2	2	1	0	11
Pleurobranchiæ	0	0	1	1	1	1	0	0	4
									16+(5)

These characters might be considered of generic value, but I prefer not to propose a new genus for these two species, and I am confirmed in this from the examination of two other species: a Japanese species (possibly the *P. affinis* (M.-Edwards), but evidently not the species figured by Bate as the male of that species) which closely resembles the *constrictus* and *barbatus* in general appearance, but has no exopods at the bases of the posterior peræopods and has the epipods and branchiæ as in *P. longirostris*; and *P. Goodei*, described beyond, which, though resembling the *constrictus* and *barbatus* in external characters, has the mandibular palpi, epipods, and branchiæ as in *P. longirostris*, and long and slender exopods at the bases of all the peræopods.

Parapenæus longirostris.

Penæus longirostris Lucas, Explor. Algérie, Crust., p. 46, pl. 4, fig. 6, 1849.

Penæus membranaceus Heller, Sitzungsber. Akad. Wiss. Wien, xlv, p. 423, pl. 2, fig. 49, 1862; Crust. südlichen Europa, p. 296, pl. 10, fig. 11, 1863.

Penæus Bocagei Johnsôn, Proc. Zool. Soc. London, 1863, p. 255; *ibid.*, 1867, p. 900 (< *longirostris*).

I take this Mediterranean species, of which I have examined a specimen received from the Rev. A. M. Norman, as the type of the genus.

Judging from his description, this is apparently not Risso's *Peneus membranaceus* (Crust. de Nice, p. 98, 1816), which is probably indeterminable. He describes the rostrum as short, and again as "un petit rostre aplati et denté," which would apply better to the Mediterranean

Solenocera, but the length given would indicate a very much larger species than the *Solenocera*. It is perhaps best to drop the name *membranaceus* entirely, or at least until it can be shown with some degree of certainty to what species it really applies.

Parapenæus politus.

Penæus politus Smith, Proc. National Mus., iii, p. 444, 1881.

Several specimens, agreeing well with the single one originally described, were taken in 1881 by the Fish Hawk, off Martha's Vineyard, in 79 to 128 fathoms, and in February, 1884, a large number were taken by the Albatross, in 31 to 34 fathoms, in the Gulf of Paria.

The species is closely allied to *P. longirostris*, and some of the specimens from the Gulf of Paria have the rostrum much longer than any of the northern specimens and approach the Mediterranean species so closely that it is quite possible that a large series of specimens might show that the *politus* is only a variety of *P. longirostris*. All the specimens seen, however, are easily distinguished from the *longirostris* by the shorter rostrum, which falls much short of the tips of the antennal scales, and by the somewhat smaller eyes.

Parapenæus megalops, sp. nov.

This species is closely allied to *P. longirostris* and *politus*, but is at once distinguished from them by the broader carapax, the more numerous teeth upon the rostrum, the very much larger eyes, and by the branchiostegial spine being on, instead of a little way back from, the anterior margin of the carapax.

The surface of the carapax and pleon is naked and smooth. The carapax is about as broad as high and very little compressed anteriorly. The antennal, hepatic, and branchiostegial spines are well developed, the latter forming the antero-inferior angle of the carapax. From the hepatic spine a sharp elevation extends backward and upward, marking the posterior margin of the cervical suture, but fades out before reaching the dorsum, which is evenly rounded posteriorly but rises in front in a carina armed with a single spine in the middle of the gastric region far back from the crowded teeth of the rostrum proper, only one or two of the most posterior of which are back of the orbit. The rostrum is a little shorter than the carapax proper, reaches to the tips of the antennal scales in all of the females seen, but falls short of them in the males, is nearly horizontal or considerably arched upward in the middle, is rapidly narrowed vertically from the base to about the middle of the eyes, beyond which it is slender and gradually tapered to an acute tip, and the dorsal edge is armed with twelve to fifteen spiniform teeth which are crowded posteriorly but become gradually more and more remote and smaller toward the tip, to which they very nearly reach.

The eyes are black, reniform, flattened above, and very large, apparently slightly larger in the males than in the females; the greatest

diameter being nearly half the length of the antennal scale, and from a third to fully two-fifths of the length of the carapax excluding the rostrum.

The proximal segment of the peduncle of the antennula is about half as long as the antennal scale, very broad, lamellar, slightly concave above to fit the eye, and the outer margin armed with a small tooth near the base and with a slender spine at the anterior angle; the second segment is scarcely a third as long as the proximal and nearly as broad as long; and the distal segment is fully as long as the second, slender and subcylindrical. The antennular flagella are slender, the inner approximately as long as the antennal scale, the outer slightly shorter. The antennal scale is considerably broader at base and more tapered distally than in *P. longirostris*, but otherwise the antennæ are nearly as in that species.

The peræopods are very similar to those of *P. longirostris*, but are all somewhat longer and apparently stouter; the second pair reach nearly to the second segment of the peduncle of the antennula, and the third and fifth to or a little by the tips of the antennal scales.

The anterior somites of the pleon are nearly as in *P. longirostris*, but the dorsal carina on the third, fourth, and fifth is not quite as thin and does not project in so distinct teeth at the posterior margins of the somites, and the pleura of the fifth somite project slightly more posteriorly.

The telson is a little longer than the sixth somite, conspicuously sulcated above, the margins of the sulcus carinated and terminating in a long spiniform process either side and a little way from the slender and acute tip. Below the dorsal carina there is an inconspicuous lateral carina either side joining the dorsal a little way from the base of the lateral process, in front of which there are two aculei on the edge itself. The inner lamella of the uropod reaches to about the tip of the telson, is ovate-lanceolate and between three and four times as long as broad. The outer lamella is considerably longer than the telson, about a fourth as broad as long, with the outer margin terminating, about two-thirds of the way from the base to the tip, in a small spine, beyond which the lamella is suddenly narrowed but the tip itself rounded.

The peculiar sexual appendage of the first pleopod is an elongated, approximately rectangular plate longitudinally plicated, and joining its fellow of the opposite side for nearly the whole length of the mesial edge.

Measurements in millimeters.

Catalogue number	7263	7262
Station	2143	2125
Sex	♂	♀
Length from tip of rostrum to tip of telson	105	140
Length of carapax including rostrum	36.5	54
Length of rostrum	16.5	25
Height of carapax	11.5	18
Breadth of carapax	11.5	17
Length of eye-stalk and eye	10.0	12
Greatest diameter of eye	8.5	10
Length of antennal scale	19.0	24
Breadth of antennal scale	5.0	7.7
Length of second gnathopod	30	45
Length of first peræopod	24	32
Length of carpus	4.8	6.5
Length of chela	5.8	8.0
Breadth of chela	1.3	1.9
Length of dactylus	3.7	4.7
Length of second peræopod	31	44
Length of carpus	10.0	14
Length of chela	5.4	7.0
Breadth of chela	1.2	1.7
Length of dactylus	3.0	4.0
Length of third peræopod	40	55
Length of merus	12	15
Length of carpus	16	22
Length of chela	6	8
Breadth of chela	1.0	1.4
Length of dactylus	3.0	3.9
Length of fourth peræopod	....	45
Length of merus	....	14
Length of carpus	....	11
Length of propodus	....	6
Length of dactylus	....	4
Length of fifth peræopod	42	55
Length of merus	15	18
Length of carpus	14	17
Length of propodus	5.5	7.5
Length of dactylus	3.2	4.0
Length of sixth somite of pereon	15	20
Height of sixth somite of pereon	8	11
Length of telson	17.5	22
Length of inner lamella of uropod	14.0	18.0
Breadth of inner lamella of uropod	4.0	5.0
Length of outer lamella of uropod	19.0	25.0
Breadth of outer lamella of uropod	4.8	6.1

This species was taken in 1884, at two stations in the Caribbean Sea, by the Albatross: Station 2125, February 18, south of Curaçoa, north latiude 11° 43′, west longitude 69° 9′ 30″, 208 fathoms, yellow mud and sand, temperature 50°.7, two females; and station 2143, March 23, Gulf of Darien, north latitude 9° 30′ 45″, west longitude 76° 25′ 30″, 155 fathoms, green mud.

Parapenæus constrictus.

Penæus constrictus Stimpson, Ann. Lyc. Nat. Hist. New York, x, p. 135, 1871.

Numerous specimens were taken in 1881 by the Fish Hawk, off Chesapeake Bay, in 18 fathoms, and in 1884 by the Albatross, off Cape Hatteras, in 7 to 27 fathoms. I have also examined specimens from Fort Macon, North Carolina, and from Bermuda.

All these specimens agree well with Stimpson's description except that the carina of the carapax is scarcely grooved longitudinally, though distinctly flattened, at the cervical suture. The dorsal crest of the rostrum proper is armed with seven to nine equidistant teeth, and back of these, on the carina of the gastric region, there is a small tooth, de-

scribed by Stimpson as the gastric tooth, and not referred to in connection with the rostral teeth, which explains the apparent discrepancy pointed out by Miers (Proc. Zool. Soc. London, 1878, p. 304) between Stimpson's description and the specimen in the British Museum. The surface of the posterior part of the branchial regions of the carapax and of the whole of the pleon, except a very narrow and inconspicuous line of pubescence either side of the dorsal carina of the fifth and sixth somites, is entirely naked and glabrous. The dorsal carina of the fourth and fifth somites of the pleon is divided by a narrow incision like that in *P. Goodei*, but not quite as deep. The telson is shorter than the sixth somite and rather suddenly tapered to a short acuminate tip armed either side with a short and very small spine.

Variety **similis.**

There are four specimens, one male and three females, taken by the Albatross, station 2121, February, 1884, Gulf of Paria, north latitude 10° 37′ 40″, west longitude 61° 42′ 40″, 31 fathoms, which appear to represent a distinct species very closely allied to *P. constrictus*, but as a large series of specimens from the West Indies would very likely show them to be only a variety, I describe them here as such.

These specimens are a little larger than the largest observed specimens of *constrictus*, and the rostrum somewhat longer, more slender, and armed with eight or nine teeth in addition to the one on the gastric region. The whole surface of the carapax and of the fourth, fifth, and sixth somites of the pleon is thickly covered with very short and stiff setæ, like those on the anterior portion of the carapax of *P. constrictus*, and the surface itself, after the removal of the setæ, is thickly punctate. The telson is considerably longer than the sixth somite of the pleon, and tapers very gradually to a very long and slender tip armed either side its base with a long and very slender spine.

Measurements of two of these specimens and of two of the largest observed specimens of the typical *constrictus* are given in the accompanying table:

Measurements in millimeters.

	P. constrictus.		Var. *similis.*	
Catalogue number	....	8870	7265	7265
Station	901	2285	2121	2121
Sex	♂	♀	♂	♀
Length from tip of rostrum to tip of telson	51	66	62	80
Length of carapax including rostrum	18.5	26.5	22.7	31.0
Length of rostrum	7.2	10.0	9.0	13.3
Height of carapax	7.0	9.6	8.0	11.7
Breadth of carapax	6.0	9.0	7.5	10.1
Length of eye-stalk and eye	4.3	6.0	5.2	7.0
Greatest diameter of eye	3.0	4.1	4.5	5.2
Length of antennal scale	8.8	11.3	11.0	13.4
Breadth of antennal scale	3.2	4.0	3.6	4.8
Length of first peræopod	9.5	15.0	12.5	18.0
Length of merus	2.4	3.6	....	....
Length of carpus	2.3	3.2	3.0	....
Length of chela	2.1	3.3	3.0	4.1

Measurements in millimeters—Continued.

	P. constrictus.		Var. *similis.*	
Breadth of chela	0.75	1.3	0.8	1.1
Length of dactylus	1.4	2.2	1.9	2.5
Length of second peræopod	13.0	19.5	17.5	25.0
Length of carpus	4.2	6.5	6.0	8.4
Length of chela	2.3	3.7	3.2	4.5
Breadth of chela	0.65	0.95	0.7	0.85
Length of dactylus	1.4	2.2	1.9	2.7
Length of third peræopod	17.5	27.0	24	36
Length of merus	4.5	7.0	6.4	10.0
Length of carpus	6.2	10.0	9.5	14.5
Length of chela	2.7	4.4	4.0	5.8
Breadth of chela	0.6	0.9	0.65	0.8
Length of dactylus	1.5	2.3	2.1	3.0
Length of fourth peræopod	15.0	21.5	20	28
Length of merus	3.7	5.3	4.9	7.7
Length of carpus	3.5	5.2	5.0	7.4
Length of propodus	2.3	3.5	3.3	4.8
Length of dactylus	1.6	3.0	2.2	3.0
Length of fifth peræopod	19.5	27.5	26	37
Length of merus	5.0	7.8	7.6	11.5
Length of carpus	4.9	7.5	7.5	11.0
Length of propodus	3.1	4.6	4.4	6.3
Length of dactylus	1.8	2.6	2.6	3.6
Length of sixth somite of pereon	6.7	8.2	8.0	10.0
Height of sixth somite of pereon	5.0	6.2	5.6	7.5
Length of telson	6.3	8.0	9.2	12.0
Length of inner lamella of uropod	6.4	8.4	8.0	9.7
Breadth of inner lamella of uropod	1.9	2.4	2.2	3.0
Length of outer lamella of uropod	7.5	9.6	9.0	10.8
Breadth of outer lamella of uropod	2.4	3.3	2.8	3.8

Parapenæus barbatus (De Haan sp.).

De Haan's species is evidently distinct from the *affinis* to which he referred it, and is apparently closely allied to *P. constrictus*. I have examined specimens from the Bay of Jeddo, Japan, which agree perfectly with De Haan's figure of *P. barbatus* and with his description, except that there is no branchiostegial spine, although the margin of the carapax projects forward in a slightly prominent angle beneath the base of the antenna. These specimens resemble *P. constrictus* closely, and agree with it perfectly in the oral appendages, the number and arrangement of the branchiæ, epipods, and exopods, and in the appendages of the first pleopods of the male, but differ in having nearly the whole surface of the carapax and pleon pubescent.

Parapenæus anchoralis (Bate sp.) is apparently closely allied to *P. constrictus*, and should undoubtedly be referred here, as should also, apparently, *P. affinis* (M.-Edwards sp.), *P. monoceros* (Fabricius sp.), and *P. velutinus* (Dana sp.). Several other of the described Pacific Ocean species probably belong to the genus, but it is impossible to determine their affinities from the published descriptions and figures.

Parapenæus Goodei, sp. nov.

This species resembles *P. constrictus*, and is apparently very closely allied to *P. velutinus* (Dana sp.), which is described as having the second and third peræopods subequal and the telson armed with minute spinules, and is figured as having the fourth peræopods fully as long as the fifth;

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while in the species here described the third peræopods are very much longer than the second, the telson is armed with long spiniform lateral processes and movably articulated spines, and the fifth peræopods are much longer than the fourth. I should regard the equality in the length of the second and third pairs of peræopods as an accidental character of the type specimen did not Bate report specimens from various localities in the Challenger collections agreeing closely with Dana's description and figure. Bate states also that, in his specimens, the petasma (sexual appendage of the first pleopod of the male) of the left side is longer than that of the right, while the reverse is true of the species here described.

The carapax and pleon are everywhere densely clothed with short and rather stiff plumose setæ. The carapax is about as broad as high and very little compressed anteriorly. There is an inconspicuous supraorbital notch, as in *P. constrictus*, and well-developed antennal, hepatic, and branchiostegial spines, the latter forming the antero-inferior angle of the carapax. The sulci are inconspicuous. The dorsum is evenly rounded posteriorly, but rises in a sharp tooth on the gastric region at the base of the rostrum, which rises suddenly above the level of the dorsum, is directed obliquely upward, is shorter than the carapax proper, and armed above with eight to ten teeth, all of which are over or in front of the orbit.

The eyes are large, reniform, flattened above, and black. The peduncles of the antennulæ are nearly as in *P. constrictus*, and the flagella are subequal in length and scarcely longer than the penultimate segment of the peduncle. The antennal scales reach to the tips of the peduncles of the antennæ, are about three times as long as broad, regularly tapered distally, and the distal portion of the thickened outer margin is armed above with a series of minute spines directed obliquely forward and outward.

The oral appendages are essentially as in *P. longirostris*.

The first and second peræopods are armed with basal spines as in *P. constrictus*, and there is in addition a small distal spine on the under side of the ischium in the first, while between the bases of the second there is a pair of long and very slender spines arising from the sternum and directed forward. The third peræopods reach as far forward as the tip of the rostrum, the full length of the chelæ beyond the second pair, and the distal portions are more slender than in the second; the carpus is about once and two-thirds as long as the merus, which is itself about as long as the carpus in the second; and the chela is scarcely stouter than the carpus and about two-fifths as long. The fourth peræopods reach about as far forward as the first, while the fifth are conspicuously longer, reaching considerably by the fourth.

The third, fourth, fifth, and sixth somites of the pleon are dorsally carinated, and on the fourth and fifth the carina is divided by a narrow and deep incision in the posterior margin, leaving an inconspicuous tooth either side which does not project above the carina of the succeeding somite. The sixth somite is strongly compressed and about once and a half as long as high. The telson is considerably longer than the sixth somite, rounded and obscurely sulcated above, regularly tapered, and armed with a long spiniform process either side of the acute tip and three pairs of movably articulated spines, of which the posterior are much the larger, arise just in front of the lateral processes, and reach beyond their tips. The lamellæ of the uropods are shorter than the telson, the outer is only slightly longer than the inner, its thickened outer margin terminates a little way from the tip, and both are narrow and obtusely rounded distally.

The appendages of the first pleopods of the male are exceedingly complicated and very different on the two sides. The left appendage is the more simple and consists of an irregularly longitudinally plicated plate which projects proximally in a curved process beyond the right appendage and to the right of the mesial line, and distally in an irregular narrow process. The right appendage is enlarged distally and divided into several irregularly curved processes projecting beyond the left appendage and partially covered posteriorly by a thin spoon-shaped lamella arising at their bases.

I have seen a single male (from which the accompanying measurements were taken), collected, with *P. constrictus*, at Bermuda, by Prof. G. Brown Goode, and several smaller specimens, both male and female, in the museum of Yale College, collected in the Bay of Panama by Prof. F. H. Bradley.

Measurements in millimeters.

Sex	♂
Length from tip of rostrum to tip of telson	57.0
Length of carapax including rostrum	19.4
Length of rostrum	9.0
Height of carapax	7.5
Breadth of carapax	7.5
Length of eye-stalk and eye	4.8
Greatest diameter of eye	4.0
Length of antennal scale	10.0
Breadth of antennal scale	3.4
Length of first peræopod	11.5
Length of carpus	2.7
Length of chela	2.4
Breadth of chela	0.7
Length of dactylus	1.3
Length of second peræopod	13.8
Length of carpus	4.7
Length of chela	2.7
Breadth of chela	0.6
Length of dactylus	1.2

Length of third peræopod	18.2
Length of merus	4.5
Length of carpus	7.4
Length of chela	3.1
Breadth of chela	0.55
Length of dactylus	1.4
Length of fourth peræopod	15.5
Length of carpus	3.8
Length of propodus	2.7
Length of dactylus	1.5
Length of fifth peræopod	17.5
Length of carpus	4.5
Length of propodus	3.3
Length of dactylus	1.5
Length of sixth somite of pereon	8.0
Height of sixth somite of pereon	5.3
Length of telson	9.5
Length of inner lamella of uropod	8.0
Breadth of inner lamella of uropod	1.7
Length of outer lamella of uropod	8.4
Breadth of outer lamella of uropod	2.1

Hymenopenæus Smith.

In the four species which I have examined both flagella of the antennulæ are slender and at least as long as the carapax, excluding the rostrum; the proximal segment of the mandibular palpus is larger and much broader than the distal, which is long and narrow; the endognath of the first maxilla is short and unsegmented; the second gnathopod and the first, second, third, and fourth peræopods have well-developed epipods; and there is, either side, a pleurobranchia on the fourteenth somite and two arthrobranchiæ on the thirteenth. The branchio-epipodal formula is—

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods	1	1	1	1	1	1	1	0	(7)
Podobranchiæ	0	1	0	0	0	0	0	0	1
Arthrobranchiæ	0	2	2	2	2	2	2	0	12
Pleurobranchiæ	0	0	1	1	1	1	1	1	6
									19+(7)

The species examined further agree in having antennal, hepatic, and branchiostegial spines, a fourth spine back of the orbit, and small epipods at the bases of all the peræopods.

The genus thus differs from both *Penæus* and *Parapenæus* in the elongated antennular flagella, the form of the mandibular palpus, and in the presence of two arthrobranchiæ and an epipod on either side of the thirteenth somite; it agrees with *Penæus* and differs from *Parapenæus* in having an epipod at the base of the second gnathopod; and it agrees with *Parapenæus* and differs from *Penæus* in having the endognath of the first maxilla short and unsegmented.

It is not at all improbable that this genus is the same as A. Milne-Edwards's manuscript genus *Penæopsis* referred to, but not characterized by Bate (Ann. Mag. Nat. Hist., V, viii, p. 182, 1881).

I have already described two species of the genus, *H. debilis* (Bull. Mus. Comp. Zool., x, p. 91, pl. 15, figs. 6-11, pl. 16, figs. 1-3, 1882) and *H. microps* (Report U. S. Fish Com., x, for 1882, p. 413, pl. 10, fig. 1, 1884), and I here add two others, which are conspicuously unlike them and each other.

Hymenopenæus robustus, sp. nov.

This species is readily distinguished from *H. debilis* and *H. microps* by its much greater size, longer rostrum, very large, reniform, and dorsally flattened eyes, and by the pubescence-like clothing of the carapax and pleon.

The entire surface of the carapax, pleon, and many of the appendages is thickly covered with a close velvety coat of very short curved setæ. The carapax is slightly compressed, but little higher than broad and slightly narrowed in front. The hepatic and cervical sutures are deep and the latter is conspicuous, extends nearly to the middle of the dorsum, and is marked posteriorly by a high and almost carinate margin. The dorsum is carinated nearly to the posterior border, but back of the cervical suture the carina is very low and the dorsum broadly rounded, while in front it gradually rises to the base of the rostrum, which is five to seven eighths as long as the carapax proper, nearly straight, and horizontal to near the slightly upturned and unarmed tip, back of which there are six to eight low teeth in front of the orbit and three or four similar ones on the carina of the carapax proper. There is an obscure supraorbital tooth and a stout antennal spine on the anterior margin, which retreats below the latter to the slightly produced inferior angle, a little way back from which there is an acute branchiostegial spine, rather larger than the hepatic and still larger than a small spine a little way back of and slightly above the antennal.

The eyes are black, reniform, flattened above, and very large, the greatest diameter being from a fourth to a third the length of the carapax excluding the rostrum.

The proximal segment of the peduncle of the antennula is fully half as long as the antennal scale, very broad, lamellar, and the outer margin armed with a small tooth and its anterior angle spiniform; the second segment is nearly half as long as the proximal, somewhat triquetral, more than half as broad as long, and densely hairy above and on the outer side; the distal segment is much shorter than the second and subcylindrical. The antennular flagella are nearly cylindrical, long, and slender, the inferior nearly or quite as long as the carapax including the rostrum, and its proximal portion densely hairy in the male, and the superior much longer and nearly naked in both sexes.

The antennal scale is two-thirds to three-fourths as long as the cara-

pax excluding the rostrum, fully a third as broad as long, the inner margin broadly curved distally, and the tip rounded. The flagellum is very nearly naked and three or four times as long as the rest of the animal.

The second gnathopods are slender, regularly tapered, and reach to about the tips of the antennal scales; the ischium and carpus are approximately equal in length and a little longer than the merus, which is slightly longer than the propodus, which in turn is longer than the dactylus.

The first peræopods reach to or a little by the middle of the carpi of the second gnathopods and are somewhat compressed: the basis and ischium are each armed with a small distal spine and there is a similar spine on the middle of the merus; the carpus and merus are approximately equal in length, and the chela is about two-thirds as long as the carpus. The remaining peræopods are unarmed. The second reach by the middle of the antennal scales: the merus is shorter than the carpus and subcylindrical; the carpus is twice as long as in the first and tapered distally; the chela is approximately as long as in the first, but much more slender and a little more than a third as long as the carpus. The third reach to about the tips of the antennal scales and are similar to the second, though the carpus is proportionally still longer. The fourth reach to about the middle of the antennal scales: the merus and carpus are approximately equal in length, but the carpus is much the more slender; the propodus is less than half as long as the carpus; and the dactylus is about three-fifths as long as the propodus, strongly compressed, with the edges sharp and a longitudinal carina on the middle of each surface. The fifth are similar to the fourth, but more slender, and reach to about the tips of the antennal scales; the propodi are proportionally longer than in the fifth, and the dactyli actually shorter, being less than a third as long as the propodi.

The dorsum of the second somite of the pleon is broad and rounded, but with a low and indistinct median carina, which becomes distinct on the third somite and sharp and high upon the compressed fourth, fifth, and sixth somites, and ends in a small tooth on the posterior margin of the sixth. The postero-inferior angles of the first and second pleura are rounded, while those of the third, fourth, and fifth are obtusely right-angled. The sixth somite is between a fourth and a third longer than the fifth, and rather more than three-fourths as high as long.

The telson is once and two-thirds to once and three-fourths as long as the sixth somite, regularly tapered, with a very shallow dorsal sulcus margined with slight carinæ which terminate in a pair of small spiniform lateral processes a little way from the acutely triangular tip.

The inner lamella of the uropod is about as long as the telson and nearly or quite three times as long as broad. The outer lamella is

about a sixth longer than the inner, rather less than three times as long as broad, and the thickened outer margin extends very nearly to the tip.

In the male the appendages of the first pleopods are very large squarish lamellar plates with the outer and distal margins slightly thickened, the latter somewhat irregularly lobed, and the mesial portion very thin and longitudinally plicated. There are three stiff chitinous stylets at the base of the inner ramus of the second pleopods, the usual pair on the mesial side and a single small one on the opposite side, the anterior of the two mesial ones is much the larger and is stout and deeply channeled for the reception of the inner, which is shorter and much more slender.

Taken by the Albatross in the Caribbean Sea, station 2125, February 18, 1884, north latitude 11° 43′, west longitude 69° 9′ 30″, 208 fathoms, yellow mud and sand, temperature 50°.7. Fourteen males and four females (6907 and 6908).

Measurements in millimeters.

Catalogue number Station	6907 2125	6907 2125	6907 2125
Sex	♂	♀	♀
Length from tip of rostrum to tip of telson	148	186	190
Length of carapax including rostrum	55	80	84
Length of rostrum	22	34	37
Height of carapax	19	27	28
Breadth of carapax	17	23	23.5
Length of eye-stalk and eye	13	15	16
Greatest diameter of eye	11	12	12
Length of antennal scale	26	31	34
Breadth of antennal scale	8.8	11.2	12
Length of second gnathopod	52	70	72
Length of first peræopod	35	47	49
Length of carpus	8.8	12	13.5
Length of chela	6.1	8.6	8.8
Breadth of chela	2.0	2.5	2.7
Length of dactylus	4.2	5.8	5.8
Length of second peræopod	46	62	64
Length of carpus	18	25	26
Length of chela	6.4	7.7	8.0
Breadth of chela	1.5	2.0	2.1
Length of dactylus	3.8	4.7	4.7
Length of third peræopod	59	80	84
Length of merus	15	21	22
Length of carpus	25.5	36	38
Length of chela	6.4	8.6	8.9
Breadth of chela	1.2	1.7	1.8
Length of dactylus	3.6	4.5	4.5
Length of fourth peræopod	54	67	72
Length of merus	15	19.3	22
Length of carpus	16	21	23
Length of propodus	7.8	9.0	10
Length of dactylus	5.0	5.8	6.0
Length of fifth peræopod	73	80	94
Length of merus	22	22.5	29
Length of carpus	21	24	29
Length of propodus	14	14	17
Length of dactylus	4.0	4.7	5.0
Length of sixth somite of pereon	17	19	19.3
Height of sixth somite of pereon	12.8	15	15
Length of telson	21	25	26
Length of inner lamella of uropod	20	23	24
Breadth of inner lamella of uropod	6.0	6.9	8.0
Length of outer lamella of uropod	25	29	30.5
Breadth of outer lamella of uropod	7.5	9.1	9.3

Hymenopenæus modestus, sp. nov.

Nearly the whole surface of the carapax is more or less pubescent, but the pubescence is very inconspicuous except in front of the cervical sulcus, where it is especially noticeable either side of the dorsal carina and along the margins of the orbits. The surface of the pleon is almost entirely naked and glabrous. The carapax is considerably compressed, slightly narrowed in front, and the dorsum is rounded and without a carina back of the cervical sulcus, while in front there is a low dorsal crest terminating in a small and nearly horizontal rostrum which is slightly more than a fourth as long as the rest of the carapax, does not reach as far forward as the eyes, terminates in an acute tip, and is armed above with three small teeth in front of the orbit and with four others in the dorsal crest back of the orbit, while beneath it is ciliated and unarmed. There is a shallow hepatic sulcus and the cervical sulcus is conspicuous, reaches nearly to the middle of the dorsum, and is bordered posteriorly by a sharp and slightly carinated margin. There is no perceptible supraorbital tooth, the antennal spine is small and less conspicuous than the one a little back of and very slightly above it, and there is a small branchiostegial spine a little way back from the evenly rounded antero-lateral angle.

The eyes including the stalks are about a fourth as long as the carapax excluding the rostrum, and the eyes themselves are black, rather small, and approximately hemispherical, but considerably compressed vertically.

The peduncle of the antenna is nearly as long as the antennal scale: the proximal segment reaches considerably beyond the eyes and the outer margin is armed with a median tooth and distal spine; the second segment is approximately three-fourths as long as the proximal, somewhat triquetral and hairy; and the distal segment is less than half as long as the second and subcylindrical. The flagella are nearly cylindrical, subequal in length, and scarcely as long as the carapax including the rostrum: the superior is slightly but suddenly narrowed about a fourth of its length from the base, and beyond this point is exceedingly slender; and the inferior is very much stouter than the superior and sparsely hairy.

The antennal scale is a little less than three-fourths as long as the carapax excluding the rostrum, slightly more than a fourth as broad as long, and uniformly tapered from the base to the very narrow but rounded tip, which reaches considerably beyond the peduncle of the antennula.

The distal segment of the mandibular palpus is approximately as long as the proximal but very narrow, being about four times as long as broad. The second gnathopods reach beyond the tips of the antennal scales by nearly the full length of the dactyli.

The first peræopods are strongly compressed and reach beyond the bases of the antennal scales by about the length of the dactyli; the

merus and carpus are subequal in length; and the chela is fully three-fourths as long as the carpus. The second peræopods are slightly compressed and reach to about the middle of the antennal scales; the carpus is slightly longer than the merus, and the chela is more slender and slightly longer than in the first pair, and a little more than half as long as the carpus. The third peræopods are much more slender than the second, and reach to about the tips of the antennal scales; the carpus is about a fourth longer than the merus, and the chela is much longer and more slender than in the second and less than half as long as the carpus. The fourth peræopods reach slightly by the bases of the chelæ of the third; the carpus is very little shorter than the merus; the propodus less than half as long as the carpus, and the dactylus is about three-fourths as long as the propodus. The fifth peræopods are more slender and more than a half longer than the fourth; the merus, carpus, and propodus are ap_roximately equal in length, and the dactylus only slightly more than a fourth as long as the propodus, although very little longer than in the fourth.

The third somite of the pleon is compressed dorsally, the fourth, fifth, and sixth are sharply carinated, and the posterior margins of the third, fourth, and fifth are incised in the middle. The sixth somite is very short, not more than a fourth longer than the fifth, and about five-eighths as high as long.

The telson is about as long as the sixth somite, has a conspicuous dorsal sulcus, which becomes broad and shallow posteriorly, and the margins of which terminate in a small spiniform process either side of the long and rather broad but apparently acute tip. The inner lamella of the uropod is shorter than the telson, ovate-lanceolate, and a little more than a fourth as broad as long. The outer lamella is a little longer than the telson, about a third as broad as long, and semi-elliptical, the outer margin being straight.

Measurements in millimeters.

Catalogue number	7267
Station	1047
Sex	♀
Length from tip of rostrum to tip of telson	50
Length of carapax including rostrum	16.8
Length of rostrum	3.6
Height of carapax	8.8
Breadth of carapax	7.0
Length of eye-stalk and eye	3.3
Greatest diameter of eye	2.2
Length of antennal scale	9.2
Breadth of antennal scale	2.5
Length of second gnathopod	23
Length of first peræopod	16.5
Length of carpus	4.0
Length of chela	3.1
Breadth of chela	0.95

Length of dactylus	2.0
Length of second peræopod	20
Length of carpus	6.0
Length of chela	3.4
Breadth of chela	0.8
Length of dactylus	2.1
Length of third peræopod	28
Length of merus	7.2
Length of carpus	9.0
Length of chela	4.2
Breadth of chela	0.75
Length of dactylus	2.6
Length of fourth peræopod	25
Length of merus	7.5
Length of carpus	7.2
Length of propodus	3.4
Length of dactylus	2.5
Length of fifth peræopod	40
Length of merus	10.0
Length of carpus	11.0
Length of propodus	10.0
Length of dactylus	2.7
Length of sixth somite of pereon	7.0
Height of sixth somite of pereon	4.5
Length of telson	7.2
Length of inner lamella of uropod	6.5
Breadth of inner lamella of uropod	1.8
Length of outer lamella of uropod	7.8
Breadth of outer lamella of uropod	2.6

I have seen only a single specimen, apparently a female, taken by the Fish Hawk, off Delaware Bay, October 10, 1881, station 1047, north latitude 38° 31′, west longitude 73° 21′, 156 fathoms, sand, temperature 49°.

The remarkable resemblance of this species to *Solenocera siphonocera* is referred to under that species.

Solenocera Lucas.

Excepting the remarkable structure of the antennulæ, which distinguishes it from all other known Penæidæ, and the form of the mandibular palpi, in which the distal segment is as broad at base as the proximal but elongated and much narrowed distally, this genus is like *Hymenopenæus*, with the species of which it agrees in the number and position of the branchiæ, epipods, and exopods, and in the form of the maxillæ, maxillipeds, gnathopods, and peræopods.

The efferent branchial tube formed by the two pairs of antennular flagella is well described by Philippi, except that the inferior flagella enter somewhat unequally into its walls, the superior flagella being considerably narrower than the inferior, forming only approximately a sixth of the periphery of the tube, which is very little narrowed distally. The antennular peduncles and the antennal scales form a posterior continuation of the tube which extends backward as a broad channel

between the bases of the peduncles of the antennæ, where it is closed in below by the mandibular palpi, and separates either side of the labrum into the passages from the branchial chambers.

Solenocera siphonocera Miers.

Penæus membranaceus M.-Edwards, Hist. Nat. Crust., ii, p. 417, 1837 (non Risso ?).

Peneus siphonoceros Philippi, Archiv Naturgesch., vi, p. 190, pl. 4, fig. 3, 1840.

Penæus siphonocerus Heller, Crust. südlichen Europa, p. 295, pl. 10, fig. 12, 1863.

Solenocera siphonocera Miers, Proc. Zool. Soc. London, 1878, p. 301, 1878.

Solenocera membranacea Bate, Ann. Mag. Nat. Hist., V, viii, p. 184, 1881.

Albatross collection, Gulf of Paria, station 2121, February 3, 1884, north latitude 10° 37′ 40″, west longitude 61° 42′ 40″, 31 fathoms, mud, temperature 67°. Three females.

I can find no characters by which to distinguish these American specimens from the Mediterranean species as described and figured by Philippi andHeller, although a direct comparison might show them to be of a distinct species.

The entire surface of the carapax and pleon is naked and glabrous. The carapax is slightly compressed laterally, and a little narrowed in front. There is a broad and shallow hepatic sulcus, and the cervical sulcus is very deep, reaches to the middle of the dorsum, where it slightly notches the dorsal carina, and is bordered posteriorly by a sharp and slightly carinated margin. There is a distinct supraorbital tooth, the antennal spine is stout and dentiform, the inferior angle ends in an acute spine about as large as the hepatic, and back of the orbit and above the antennal spine there is a large, prominent, and acute spine. Back of the cervical sulcus the dorsal carina is prominent and sharp nearly to the posterior margin, and in front it rises rapidly in a high crest terminating in the nearly straight rostrum, which is rather high, strongly compressed at base, and regularly tapered to an acute tip, and which is armed above nearly to the tip with four to six teeth, besides two to four upon the dorsal crest back of the orbit.

The eyes are black, large, swollen, approximately hemispherical, and very slightly flattened above.

The tube formed by the flagella of the antennulæ is a little longer than the carapax including the rostrum, and its diameter about that of the penultimate segment of the antennular peduncle. The antennal scale is approximately half as long as the carapax including the rostrum, and more than a third as broad as long. The antennal flagellum is slender, subcylindrical, and at least twice as long as the rest of the animal.

The proportions of the peræopods are sufficiently indicated in the accompanying table of measurements.

The third, fourth, fifth, and sixth somites of the pleon are dorsally carinated, the carina is sharp and high on the last three somites, and

the posterior margins deeply incised in the middle on the third, fourth, and fifth. The sixth somite is short, not more than a fourth longer than the fifth, and fully three-fourths as high as long. The telson is much longer than the sixth somite, has a conspicuous dorsal sulcus, which becomes broad and shallow posteriorly, and of which the margins terminate in a small spiniform process either side of the long and rather broad but acute tip. The inner lamella of the uropod is shorter than the telson, ovate-lanceolate, and about a third as broad as long. The outer lamella is approximately as long as the telson, more than a third as broad as long, and semi-elliptical, the outer margin being straight and extending to the extreme end of the lamella.

In general appearance this species strikingly resembles *Hymenopenæus modestus*, described above. The form of the carapax is very similar, although there are marked differences in the rostrum, dorsal carina, and the spines of the anterior margin, as shown in the descriptions. The pleon alone would be scarcely distinguishable from that of the *Hymenopenæus*.

Measurements in millimeters.

Catalogue number	7266	7266
Station	2121-2	2121-2
Sex		
Length from tip of rostrum to tip of telson	43	69
Length of carapax including rostrum	14.0	23.4
Length of rostrum	3.5	7.6
Height of carapax	8.0	11.3
Breadth of carapax	6.0	8.5
Length of eye-stalk and eye	4.0	6.0
Greatest diameter of eye	3.1	5.0
Length of antennal scale	7.2	11.7
Breadth of antennal scale	2.6	4.1
Length of second gnathopod	21	32
Length of first peræopod	14	22
Length of carpus	3.7	6.0
Length of chela	2.7	3.8
Breadth of chela	0.8	1.1
Length of dactylus	1.7	2.6
Length of second peræopod	20	31
Length of carpus	7.0	12
Length of chela	3.0	4.4
Breadth of chela	0.6	0.9
Length of dactylus	1.8	2.8
Length of third peræopod	26	43
Length of merus	6.5	12.0
Length of carpus	11.7	2[illegible].0
Length of chela	3.5	5.2
Breadth of chela	0.5	0.8
Length of dactylus	2.0	2.9
Length of fourth peræopod	21.5	33
Length of merus	5.0	8.0
Length of carpus	5.7	9.7
Length of propodus	3.7	5.2
Length of dactylus	2.6	4.0
Length of fifth peræopod	31	44
Length of merus	7.5	11.5
Length of carpus	8.0	12.0
Length of propodus	8.0	12.7
Length of dactylus	3.0	5.0
Length of sixth somite of pereon	5.0	7.5
Height of sixth somite of pereon	3.7	6.5
Length of telson	6.0	11.5
Length of inner lamella of uropod	4.8	9.0
Breadth of inner lamella of uropod	1.6	3.0
Length of outer lamella of uropod	6.2	10.0
Breadth of outer lamella of uropod	2.4	3.9

Bate incorrectly gives "Fabr." as authority for the name *membranacea*, and, apparently not having read Philippi's description, misapprehends the structure and purpose of the antennular flagella.

Xiphopeneus Smith.

This genus, which has been united with *Penæus* by Miers and Kingsley and is not referred to by Bate, is apparently a valid one. It differs from the three genera already defined in the great length of the fourth and fifth peræopods, of which the propodi are multiarticulate and flagelliform, as in *Benthœcetes*. [This is characteristic of the female as well as the male.] It agrees with *Penæus* and *Parapenæus* and differs from *Hymenopenæus* in the form of the mandibular palpus. It agrees with *Parapenæus* and *Hymenopenæus* and differs from *Penæus* in the short and unsegmented endognath of the first maxilla and in having no branchiæ on the fourteenth somite; and it agrees with *Hymenopenæus* and differs from *Penæus* and *Parapenæus* in the long flagella of the antennulæ. The branchio-epipodal formula is the same as in *Parapenæus constrictus*. In the type species the epipod of the maxilliped is prolonged in a slender but not segmented tip, and there are exopods at the bases of all the peræopods.

Xiphopeneus Kroyeri.

Penæus Kroyeri Heller, Sitzungsber. Acad. Wiss. Wien, xlv, p. 425, pl. 2, fig. 51, 1862.

Xiphopeneus Harttii Smith, Trans. Conn. Acad., ii, p. 28, pl. 1, figs. 1–1*b*, 1869.

I have seen only the type specimens of my *X. Harttii.*

Aristeus ? foliaceus.

? *Penæus foliaceus* Heller, Stizungsber. Akad. Wiss. Wien, xlv, p. 424, pl. 2, fig. 50, 1862.

Station 2143, March 23, 1884, Gulf of Darien, north latitude 9° 30′ 45″, west longitude 76° 25′ 30″, 155 fathoms, green mud. One male (7264).

This specimen represents a species congeneric with my *Aristeus ? tridens*, but specifically very distinct from it. I refer it doubtfully to the Mediterranean species described by Heller as *Penæus foliaceus*, although it agrees well with the outline figure of the carapax and the short description given by that author.

The carapax is similar to that of *A.? tridens*, but the rostrum is longer and armed with many more teeth, there is a well-developed hepatic spine, and the anterior margin retreats very much more from the antennal to the branchiostegial spine. The rostrum is longer than the rest of the carapax, with a high dorsal crest extending further forward than in *A.? tridens* and armed with five long spiniform teeth directed forward, of which the second is highest and over the posterior part of the margin of the orbit, and the fifth considerably in front of the eye, while the terminal portion of the rostrum beyond the fifth tooth is nearly straight, directed slightly upward and armed with four

teeth, the last of which is some distance from the acicular tip. The rostrum is unarmed below. The surface of the carapax, and parts of that of the pleon also, are clothed with very short and dense pubescence.

The eyes are much larger than in *A.? tridens*, nearly spherical, much larger than the slender and nearly cylindrical stalks, and black.

The proximal segment of the peduncle of the antennula is deeply excavated above and armed with a slender lateral process tipped with an acicular and slightly out-curved spine, just in front of which there is a similar spine terminating the distal angle of the segment itself. The antennæ are very nearly as in *A.? tridens.*

The crowns of the mandibles are as in *A. ? tridens*, but the palpi differ conspicuously, the proximal segment being slightly shorter and the distal very much longer, nearly as long as the proximal, with the lateral expansion at the base narrow and more prominent, and the distal portion twice as long as broad. The palpus is in fact more like Miers's figure of the palpus of *A. Edwardsianus* than that of *A.? tridens.* The maxillæ are as in *A.? tridens.* The protopod and the two proximal segments of the endopod of the maxilliped are also as in that species, but the third segment of the endopod is less than half as broad as long, the terminal segment is a third as long as the penultimate and scarcely half as broad as long, and the exopod terminates in a short but acuminate, slender, multiarticulate and flagelliform tip. The endopod of the first gnathopod is like that of *A.? tridens*, but the exopod is large, as in the typical species of *Penæus*, being nearly twice as long as the endopod, and stout. The second gnathopod is very nearly as in *A.? tridens.*

The number and arrangement of the branchiæ are the same as in *A.? tridens*, but the pleurobranchia of the eighth somite is rudimentary and that of the ninth small. There are no exopods at the bases of any of the peræopods, which in other respects are very similar to those of *A.? tridens.*

The general form of the pleon is very similar to that of *A.? tridens*, but the dorsal spines of the third and fourth somites are very small, no larger than that of the fifth somite, and the pleura of the third, fourth, and fifth are evenly rounded instead of angulated posteriorly.

The telson is nearly a third longer than the sixth somite, regularly and acutely triangular, dorsally and laterally sulcated to near the very slender and acute tip, and armed with three or four pairs of lateral spinules which increase in size distally, and of which the last pair are approximately twice their length from the tip. The inner lamella of the uropod is nearly as long as the telson, ovate-lanceolate, and nearly four times as long as broad. The outer lamella is more than a third longer than the inner, more than four times as long as broad, and ovately pointed.

The pleopods are nearly as in *A.? tridens*, but the sexual appendage of the first pair in the male is smaller, much narrower, and apparently not fully developed, the specimen probably being immature. The sterna of the four anterior somites of the pleon are each armed with a laterally compressed median tooth, which is very prominent on the first and diminishes in size successively on the succeeding somites.

Measurements in millimeters.

Sex	♂
Length from tip of rostrum to tip of telson	110
Length of carapax including rostrum	56
Length of rostrum	31.3
Height of carpax	12.0
Breadth of carapax	10.5
Length of eye-stalk and eye	5.6
Greatest diameter of eye	4.0
Length of antennal scale	15.0
Breadth of antennal scale	6.3
Length of second gnathopod	33
Length of first peræopod	27
Length of chela	6.6
Breadth of chela	1.3
Length of dactylus	3.7
Length of second peræopod	35
Length of chela	7.5
Breadth of chela	1.2
Length of dactylus	4.5
Length of third peræopod	41
Length of merus	13.5
Length of carpus	12.5
Length of chela	8.6
Breadth of chela	1.2
Length of dactylus	5.1
Length of fourth peræopod	41
Length of merus	13
Length of carpus	9.5
Length of propodus	8.9
Length of dactylus	3.8
Length of fifth peræopod	42
Length of merus	12.7
Length of carpus	9.5
Length of propodus	9.4
Length of dactylus	3.7
Length of sixth somite of pereon	11.3
Height of sixth somite of pereon	8.0
Length of telson	14.0
Length of inner lamella of uropod	13.0
Breadth of inner lamella of uropod	3.5
Length of outer lamella of uropod	19.5
Breadth of outer lamella of uropod	4.5

NEW HAVEN, CONN., *April* 29, 1885.

ON STATHMONOTUS, A NEW GENUS OF FISHES RELATED TO MURÆNOIDES, FROM FLORIDA.

By TARLETON H. BEAN,

Curator of the Department of Fishes.

Among the valuable collections of marine animals recently made for the National Museum by Mr. Henry Hemphill at Key West, Fla., are two examples of a fish which has a very close superficial resemblance to *Murænoides*, to which it seems to be nearly related.

The genus *Murænoides*, however, is an inhabitant of northern seas, and, on our eastern coast, has never been recorded even as far to the southward as Cape Hatteras. It is, therefore, a matter of considerable surprise to find a fish of this type in comparatively shallow water in close proximity to the tropics.

At first I was inclined to refer the species to the genus *Murænoides*, but upon subsequent examination it exhibited characters which fully warrant its separation as a new genus.

Stathmonotus, new genus. (Σταθμη, a carpenter's rule.)

The body is moderately long and low, much compressed. The head is small, compressed, naked; the mouth is small, oblique; conical teeth in both jaws, in two series, the outer of which is slightly enlarged, and in the upper jaw somewhat recurved. There are a few teeth on the vomer. The gill-membranes are as in *Murænoides*. Scales, none. No lateral line. The dorsal fin is long and low, beginning near the head, and consisting entirely of stiff, sharp spines, which are very short anteriorly and very gradually increase in size posteriorly. The anal is similar to the dorsal, and contains two spines and many soft rays. The caudal fin is short, rounded, and scarcely separated from the dorsal and anal. The pectorals are small, much smaller than in *Murænoides*, and contain only a few rays. The ventrals are better developed than in *Murænoides* and their position is more anterior. They consist of a spine and two rays. Pseudobranchiæ absent. Branchiostegals, 5.

Stathmonotus hemphillii, new species. (Plate XIII, Proc. Nat. Mus., 1885.)

The catalogue number of the type specimens is 37193.

The end of the maxilla extends about to the vertical through the hind margin of the eye. The jaws are subequal, or the lower projects very slightly beyond the upper. The eyes are small, separated by an interspace about equal to their own length and very slightly greater than the length of the snout. The eye is about one-sixth as long as the head. The pectoral is very little more than one-fourth as long as the head and scarcely as long as the ventral.

The greatest height of the body is contained 8 or $8\frac{1}{2}$ times in its

length to caudal base. The length of the head is one-seventh of the total without caudal. The dorsal begins over the posterior end of the pectoral; its anterior spines are very much shorter than the posterior ones. The length of the caudal is about equal to the length of the post-orbital part of the head. The vent is slightly in advance of the middle of the total length to base of caudal, and is about under the twentieth spine of the dorsal.

Colors from the alcoholic specimen: A white line extends from the tip of the snout to the caudal and is divided into small segments by short cross-bars, the first two of which are on the head and the last at the origin of the caudal. Posteriorly these short bars extend downward, terminating slightly below the base of the dorsal fin. There are several white blotches, simulating bars, on the posterior half of the anal fin, and the caudal has a white margin. Sides and under surface of the head with several whitish oblique bands forming V-shaped markings. A few roundish white blotches on the sides of the head, the most conspicuous of which is behind the eye. The general color is dark brownish, nearly black.

D. LI; A. II, 27; V. I, 2; P. 5 or 6.

Plate XIII represents the species four times the natural size. The drawing was made by Mr. H. L. Todd.

NOTE ON STOASODON NARINARI, EUPHRASEN.

By **TARLETON H. BEAN,**

Curator of the Department of Fishes.

The National Museum received May 21, 1885, from Mr. E. F. Denechaud, a fine specimen of the above species, which was brought to the New Orleans market from near Cedar Keys, Fla.

The general color of the whole upper surface is chocolate brown, everywhere sprinkled with roundish or oblong pearly blotches, the largest of which are about as long as the eye and the smallest less than one half as long. The iris is yellowish-gray. The under surface is milky white, except the margin of the snout, which is very dark gray. The tail is uniform chocolate-brown.

The middle of the interorbital space contains a long furrow, which is deepest in front and becomes shallow posteriorly. The greatest width of this furrow is 30 millimeters. The anterior edge of the pectorals is about at the lower margin of the spiracle.

The spiracles are obliquely placed.

Measurements.

(Catalogue number of specimen, 37196.)

	Millimeters.
Length of disk to posterior angle of ventral	550
Greatest width of disk	980
Length of tail from posterior angle of ventral	1,405

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	Millimeters.
Greatest thickness of body	130
Height of head at eye	85
Length of snout	76
Width of snout at nostrils	88
Distance from snout to eye, obliquely	98
Distance from tip of snout to vent	572
Distance from tip of snout to nostril	77
Tip of snout to posterior margin of mouth	119
Distance from tip of snout to first gill-opening	205
Distance from tip of snout to origin of dorsal	570
Distance from tip of snout to spiracle, obliquely	148
Distance between nostrils in front	43
Width of mouth	57
Width of superior dental lamina	50
Width of inferior dental lamina	35
Extent of projection of inferior dental lamina	20
Length of eye	36
Length of iris	14
Interorbital width on the bone	86
Distance between anterior gill-openings	155
Distance between posterior gill-openings	100
Length of third gill-opening	20
Length of surface occupied by gill-openings	89
Length of nasal flap from anterior margin of nostril	44
Greatest width of nasal flap	63
Distance from spiracle to tip of pectoral	478
Greatest length of spiracle	47
Greatest width of spiracle	31
Length of dorsal base	36
Length of middle ray of dorsal	36
Length of last ray of dorsal	23
Length of ventral, including cartilaginous prominence	157
Greatest width of ventral	73
Height of tail at root	23
Width of tail at root	28

ON THE AMERICAN FISHES IN THE LINNÆAN COLLECTION.

By G. BROWN GOODE and TARLETON H. BEAN.

Alexander Garden, one of the earliest American naturalists, was a physician, resident in Charleston, South Carolina, in the middle of the last century. He was an enthusiastic collector and in constant correspondence with the great Swedish naturalist, many of his letters, with the accompanying notes upon his collections, being preserved in the two volumes of Smith's "Correspondence of Linnæus."

He was more especially a botanist, and his contributions to science

in that department are fitly commemorated by the name *Gardenia*, applied by Linnæus in his honor to the beautiful Cape Jessamine. He collected also reptiles and fishes, and was so careful and conscientious a preparator that almost all of the fishes sent by him to Sweden are still in existence, though the other fishes upon which Linné worked are in a much less satisfactory state of preservation, and most of them indeed have gone to destruction.

Garden's method was to skin half of the fish, leaving the vertical fins attached, to press it in a botanical press, varnish it, and glue it to a sheet of herbarium paper.

These specimens are preserved in the rooms of the Linnæan Society of London, in Burlington House, in connection with the Linnæan herbarium and library.

In the summer of 1883, by the courtesy of Dr. William Murie, librarian of the Linnæan Society, we were permitted to make a careful study of the Linnæan fishes, and especially of the American forms, which were, as has been remarked, almost all collected by Garden, and which were named and described by Linné in the tenth and twelfth editions of his *Systema Naturæ*. The results of these studies are presented in the following paper, which we hope may prove to be a contribution to stability of American ichthyological nomenclature.

The notes are arranged in the order in which the several species are discussed in the twelfth edition of the *Systema Naturæ*.

The following important changes in nomenclature seem to be necessary as a result of this investigation:

1. *Coryphæna psittacus*, L. is a *Xyrichthys*, identical with *X. vermiculatus*, Poey, which must hereafter be called *Xyrichthys psittacus*.

2. *Zeus gallus*, L. is *Selene argentea*, Lac., which must therefore be called *Selene gallus*.

3. *Zeus vomer*, L. is *Vomer setipinnis*, Auctorum, which unfortunately must be called *Vomer vomer*, if we retain our proper regard for priority in the use of specific names.

4. *Pleuronectes dentatus* = *Paralichthys dentatus*, Auctorum, and *P. ophryas*, J. & G., characterized by the presence of numerous gill-rakers.

5. *Sparus chrysops*, L. and *Sparus argyrops*, L. were founded upon specimens of the same species, which is the northern form. Dr. Bean has already indicated that this form should be known as *Stenotomus chrysops*, while for the southern form he has adopted the name *S. aculeatus*. (BEAN, Proc. U. S. Nat. Mus.)

6. *Labrus hiatula*, L. is undoubtedly the *Tautog*. If a name based upon a mutilated specimen is to be allowed to stand this species must be known as *Hiatula hiatula;* it is to be hoped, however, that the revised codes of nomenclature will not force us into this usage.

7. *Perca rhomboidalis*, L. is *Lagodon rhomboides*, Auctorum. It would seem, therefore, that this species must be called *Lagodon rhomboidalis*.

8. *Perca guttatus*, L. is *Epinephelus lunulatus*, Poey, which should be called *Epinephelus guttatus*.

9. *Clupea thrissa*, L. is undoubtedly an Indo-Pacific species of *Opisthonema*. The Carolina specimens referred by Linnæus to that species were of the species *Dorosoma cepedianum*. Our *Opisthonema* must therefore probably be called *O. oglina* (Les.).

Trichiurus lepturus, L.

LINNÉ, Syst. Nat., ed. xii, 429.

No. 1, Garden. Snake Fish.

In the twelfth edition of the *Systema Naturæ* there is no reference to this Gardenian specimen of the Hair-tail, and no writing of Linné's is on the reverse of the label. Garden's specimen is in bad condition; it is about 780^{mm} long.

Gadus tau, L.

LINNÉ, Syst. Nat., ed. xii, 439.

No. 16, Garden.

There are two specimens of this species, the larger of which is 160^{mm} long. They represent the ordinary form of *Batrachus tau*.

Echeneis naucrates, L.

LINNÉ, Syst. Nat., ed. xii, 446.

No. 32, Garden. Sucking Fish.

These specimens are not referred to by Linné, who evidently placed them at once with his *Echeneis naucrates*, already described, and to which he also refers Catesby's plate 26. These have 24 laminæ in the disk. The larger one is 340^{mm} in length to caudal base.

Coryphæna psittacus, L.

LINNÉ, Syst. Nat., ed. xii, 448.

The type of this species was labeled in Linné's own writing, and marked No. 20 (evidently the No. 20 referred to, on page 313, Correspondence with Linné by Garden, as a fish of surpassing beauty); it is the species which has long been known as *Xyrichthys vermiculatus*. Linné's description agrees fully with this example, except in the count of the dorsal, which for some unknown reason is $\frac{9}{29}$ instead of $\frac{9}{22}$, as Linné would have made it. All the other fin rays are correctly given.

The length of the type to caudal base is 151^{mm}, and the characters are as follows: D. IX, 12; A. III, 12; the last of the dorsal and anal rays double; V. 6; P. 11; C. 14; scales, 2 above, tubes about 24 in all.

Lateral line interrupted under the tenth ray of dorsal. Accessory line beginning on the median line under the end of upper lateral line, and consisting of 5 short tubes.

Height one-third of length to caudal base; head one-fourth.

Eye about equal to upper jaw, and placed about at top of head.

The species must be called *Xyrichthys psittacus*, (L.).

Dr. Günther supposed *Coryphæna psittacus*, L., to be a *Pseudoscarus*, Cat. IV, 225. That *Pseudoscarus* has received another name.

Cottus scorpius, L.

LINNÉ, Syst. Nat., ed. xii, 452.

The condition of the typical specimen is very bad; it appears, however, to resemble closely enough our Scandinavian specimens of that species.

The length of the maxilla is contained $2\frac{1}{5}$ times in the length of the head; the length of the orbit $3\frac{2}{3}$ times.

The second dorsal has 14 rays; the anal 11; pectoral 17.

Zeus gallus, L.

LINNÉ, Syst. Nat., ed. xii, 454.

This is a species of *Selene.*

D. VII, 21, the longest spine more than twice as long as the base of the second dorsal. A. II, I, 19; lateral line not armed. The preanal spines are not much developed. The length of the typical example is about $4\frac{1}{2}$ inches. V. 6; its longest ray equals base of soft dorsal.

The species is identical with the *Zeus capillaris* of Mitchill, and we must use the name *Selene gallus* for that species. If the *Selene argentea* of Lacépède be only the adult stage of *capillaris*, then Lacèpéde's name, with that of Mitchill, must fall into the synonymy of *Selene gallus.*

Zeus vomer of Linné is the species which has long figured in American writings as *Vomer setipinnis*, which must now be called *Vomer vomer*, or if *Selene* and *Vomer* are not distinct, we must apply to it the name *Selene vomer.*

Pleuronectes plagiusa, L.

LINNÉ, Syst. Nat., ed. xii, 455.

The type of this species may have come from Africa or India. There is considerable doubt as to its origin. (See Garden's Correspondence with Linné, page 314.)

D. ca. 92; A. ca. 75; Scales ca. 77.

The species is more elongate than our specimens of *Aphoristia plagiusa*, so called, the depth being contained in the total length without caudal $4\frac{1}{3}$ times, and the head 6 times. In American specimens of *Aphoristia plagiusa*, so called, there are not fewer than 85 scales in a longitudinal series. The scales in Linné's species are certainly larger than in ours. The depth is contained $3\frac{1}{4}$ times in the total length to caudal base, and the head about 5 times. Under the circumstances it would be better to apply the name *Aphoristia ornata*, Lac., to our species.

Pleuronectes lineatus, L.

LINNÉ, Syst. Nat., ed. xii, 458.

No. 26, Garden. The Sole.

This specimen is marked "*lineatus*" by Linné, and in edition xii, page 458, is referred to the species *Pleuronectes lineatus*, which had, in edition x, been established upon a description of Brown, Jamaica, 445, and the description and figure of Sloan.

The length of the example to caudal base is 141^{mm}. The greatest height equals $\frac{1}{2}$ of this length, and the length of the head $\frac{2}{9}$.

D. 53; A. 40.

Pleuronectes dentatus, L.

LINNÉ, Syst. Nat., ed. xii, 458.

No. 28, Garden. Plaice.

The type of *Pleuronectes dentatus*, edition xii, page 458, is 240^{mm} long to the base of caudal; the total length is 280^{mm}. The height of the body is contained 3 times, and the length of the head about $4\frac{1}{6}$ times in the total without caudal. The length of the maxilla is contained $9\frac{1}{3}$ times in the standard body length, and slightly exceeds the length of the longest dorsal ray. The upper eye is very little in advance of the lower, and is one-fifth as long as the head. The interorbital space is very narrow. Teeth large, the longest one in front of the lower jaw being 3^{mm} long. The length of the maxilla is 26^{mm} and is contained about $2\frac{1}{5}$ times in the length of the head. There are eleven large teeth on the left side of the lower jaw and two minute ones behind these.

Gill-rakers 5–16, the longest being 6^{mm} in length, or about one-half as long as the upper eye.

D. 84; A. 66; scales about 103. The dorsal begins above the front margin of the eye.

The pectoral is as long as the maxilla, and about equal to the longest dorsal ray.

The ventral is short, somewhat imperfect, one-fourth as long as the head.

Pleuronectes lunatus, L.

LINNÉ, Syst. Nat., ed. xii, 459.

No. 9 (Garden ?).

The specimen of *Pleuronectes lunatus* in the Linné collection measures 245^{mm} to origin of middle caudal rays, 290 in total. The habitat is stated to be "in America septentrionali."

The height is contained $2\frac{1}{2}$ times and the length of the head 4 times in the length to caudal base. The maxilla, 26^{mm} long, is three-sevenths as long as the head. The length of the upper eye is contained $5\frac{1}{3}$ times in the length of the head. The eyes are about even in front. The interorbital space is very narrow, about one-third of the length of the upper eye. The teeth are as large as in the preceding example; those of the lower jaw are largely wanting.

The dorsal begins above the front margin of the eye. Its longest ray is about two-fifths of the length of the head.

Gill-rakers 5–15, the longest 7^{mm} long, or about two-thirds of the length of the eye. The rakers, as in the preceding specimen, are minutely dentate, and their width at the base is about one-fourth of their length.

The pectoral is very slightly longer than the maxilla. The ventral is one-fourth as long as the head.

D. 87; A. 69 (and not 79, as Linné gives it). Scales as in the preceding, though not counted.

There is no doubt whatever that this specimen of *lunatus* and the one of *dentatus* belong to the same species. There is no proof that the one marked *lunatus* came from Garden, but the writing seems to be his.

Chætodon alepidotus, L.

LINNÉ, Syst. Nat., ed. xii, 460.

The types of *Chætodon alepidotus* are still preserved; the fin formulæ being as recorded by Linné.

The *Stromateus paru* of Linné, ed. x, 248, ed. xii, 432, was founded entirely upon Sloan's figure, pl. 250, fig. 4. While the subject of this figure may possibly have been the common long-finned *Stromateus* of the Atlantic coast of the United States, we prefer to retain the specific name *alepidotus*, which is accompanied by a description based upon the study of specimens, and concerning which there can be no doubt. Sloan's delineation of the pampus is at the best but a gross caricature, and Linné himself was unable to consider it identical with Garden's specimens, which he described under another name, *alepidotus*.

Chætodon triostegus, L.

LINNÉ, Syst. Nat., ed. xii, 463.

No. 22, Garden. Angel Fish.

In the twelfth edition Linné referred the angel fish, which he had received from Garden, to *Chætodon triostegus*, a species which he had previously described, edition x, page 274, as having its "habitat in Indiis."

In the annotated copy of edition xii, page 463, the reference to the Garden specimen, with the descriptive paragraph, is erased, with the remark, "Pertinet ad *Chætodon faber*," this species having been described by Broussonet in 1782.

The specimen evidently represents the common American form, *Chætodipterus faber*.

Sparus chrysops, L.

LINNÉ, Syst. Nat., ed. xii, 471.

No. 6, Garden. Porgee.

The name *Sparus chrysops* is in Linné's writing. The type of the species measures 190^{mm} to base of caudal, and has the following characters:

D. XII, 12, and not XIII, 11, as stated by Linné; the thirteenth, which Linné mistook for a spine, is really a ray, broken off and somewhat sharp at the point, and the articulations can be very plainly seen with a magnifying glass of low power.

A. III, 11; scales 6 or 7–50–15.

The third dorsal spine is one-fourth as long as the entire dorsal base, and slightly longer than the seventh and eighth spines. The tips of the fourth, fifth, and sixth spines are broken off.

The second anal spine is as long as the third, but stronger, its length being exactly one-third of that of the anal base.

The pectoral is not quite perfect, but its longest ray (fourth), if laid straight back, would reach the vertical through the second anal spine at present.

The greatest height of the body is four-ninths of the length to caudal base. The length of the head is contained $3\frac{1}{4}$ times in the total without caudal. The eye is three-elevenths as long as the head and the orbit about one-third as long. The length of the anal base is one-fourth of the total without caudal.

The incisors are *very narrow*, and much compressed, the widest one in the upper jaw being only about three-fourths of a millimeter in width, while its exposed length is scarcely 2^{mm}. The molars are in two rows, the inner row containing larger teeth than the outer; but even the inner molars are comparatively small.

The species is our present *Stenotomus chrysops.*

Sparus argyrops, L.

LINNÉ, Syst. Nat., ed. xii, 471.

No. 7, Garden. Porgee.

The type is named in Linné's own handwriting. It measures 183^{mm} to caudal base, and has the following characters:

D. XII, 12; A. III, 11; scales 6 or 7–49–14.

The third dorsal spine is broken, but the fourth seems almost perfect. Its length is contained $3\frac{1}{2}$ times in that of the dorsal base. The seventh and eighth spines are only one-fourth as long as the dorsal base.

The second anal spine is a little more than one-third as long as the anal base; the third anal spine is imperfect.

The pectoral rays are all broken, but the portion of the longest one now remaining would reach to the vertical through the anal origin.

The greatest height of the body is contained $2\frac{1}{5}$ times in the length to caudal base; the length of the head about $3\frac{1}{3}$ times. The eye is three-elevenths as long as the head. The anal base is one-fourth as long as the total without caudal.

The incisors are exactly the same as in the type of *S. chrysops*, and the molars just as in the other. The eyes of the two types, as far as we can see now, are both yellow. The upper jaw in both is about one-third as long as the head.

There is no apparent difference between the types of *Sparus chrysops* and *S. argyrops;* the only evident foundation for the two names is the mistake as to the number of spines in *chrysops* and of anal rays in *argyrops.*

Sparus virginicus, L.

LINNÉ, Syst. Nat., ed. xii, 472.

No. 10.

The length of the specimen to the end of the large scales is about 195^{mm}, the height 95^{mm}, and the head about 62^{mm}.

The second spine of the dorsal equals one-half the length of the base of soft dorsal, and is about equal to that of the second anal spine. The eye is one-quarter as long as the head; the head one-third of the length to caudal base.

D. X, i, 18; A. III, 10; scales 10–62–18; there are 62 counting to the extremity of the lateral line, the last 4 or 5 being smaller than those preceding.

In the annotated copy of edition xii Linné has written the following addition to the printed description: "radiis compressis ut in dorsali. Corpus ovatum. Dentes subulati, æquales, approximati."

Labrus auritus, L.

LINNÉ, Syst. Nat. ed. xii, 475.

No. 43, Garden. "Fresh-water Bream."

This is the copper-nosed bream, with coarse squamation and heavy nape, and with a broad, long ear.

The longest dorsal spine equals the longest anal; its length is one-eighth of the total without caudal, and about two ninths of the greatest height. There are six rows of scales on the preoperculum.

D. X, 11; A. III, 10; Sc. 7–45–14.

Another example, labeled by Linné *Labrus auritus* (No. 11, Garden. See Correspondence, page 311, second line from bottom), is apparently the ordinary form of long and slender eared sunfish, which we find in more northern rivers, as the Potomac and the Susquehanna.

D. X, 11; A. III, 9; Sc. 7½–47–14.

The longest dorsal spine equals the third anal spine in length, and is about one-eighth of the total length to the end of the lateral line, and about one-quarter of the greatest height. Seven rows of scales on pre-operculum. The maxilla is as long as the orbit and about one-third as long as the head.

The external characters of these two typical specimens seem to agree pretty closely. The pharyngeal teeth and the gill-rakers could not be examined.

Labrus rufus, L.

LINNÉ, Syst. Nat., ed. xii, 475.

No. 7, Garden. Spanish Hog Fish.

This is the specimen which Garden procured from the island of Providence. Linné did not receive it until after the twelfth edition was printed.

The anal spines seem to have been overlooked by Linné in his description of the species.

D. XII, 10; A. III, 12.

This is *Harpe rufa*, (L.) Gill.

Labrus hiatula, L.

LINNÉ, Syst. Nat., ed. xii, 475.

No. 14, Garden.

(See Smith's Correspondence, p. 313.)

A half skin without anal fin is labeled as above. Its length without caudal is 230^{mm}.

D. XVII, 10 (see Linné xii, 475); scales at least 65 in lateral line.

The species is evidently the Tautog, and if the genus *Hiatula*, based upon a mutilated specimen, is considered worthy of retention, we must call our species *Hiatula hiatula.*

Perca saltatrix.

LINNÉ, Syst. Nat. ed. x, p. 293.

This is a useless name and should be ignored forever hereafter. It is founded upon Catesby's *Perca marina sectatrix*, a species of *Kyphosus* (*Pimelepterus*), familiarly known as *P. Bosci*, p. 8, pl. 8, 2d fig. The name *saltatrix* was a *lapsus pennæ* of Linnæus. In the annotated copy of edition x the name is changed to *sectatrix*, and so appears in edition xii, p. 480. The *Gasterosteus saltatrix* of ed. xii refers clearly to *Pomatomus*, and is collated with pl. 14 of Catesby.

Perca rhomboidalis, L.

LINNÉ, Syst. Nat., ed. x, 293.

This is a half skin of *Lagodon rhomboides.* The length without caudal is 183^{mm}.

D. XII, 11; A. III, 11; Sc. 9–65–16.

This is *Perca rhomboidalis* of edition x, page 293, as is indicated by identical synonymy, and the note in Linné's handwriting referring *Perca rhomboidalis* to the genus *Sparus.*

Perca punctatus, L.

LINNÉ, Syst. Nat., ed. xii, 482.

The *Perca punctata* of the tenth edition, page 291, is founded upon Catesby's "Negro Fish—*Perca marina puncticulata*"—page 7, Plate VII, upper figure, and is apparently a species of *Epinephelus.* By a slip of the pen Linné wrote *punctata* instead of *puncticulata;* it was doubtless his intention to call the species *puncticulata*, following Catesby, otherwise the anomaly of two species of the same name in the same genus would hardly have occurred.

Perca punctatus, edition xii, 482 (changed to *punctata* in the annotated copy of edition xii, in Linné's handwriting), is founded upon two specimens of *Bairdiella*, sent by Garden (No. 12, Yellow-Tail), this labeled *Perca punctata* in Linné's writing being still preserved by the Linnean Society of London.

No. 5, Garden. Sea Trout.

The basis of the description of *Perca punctatus*, edition xii, 482, was perhaps in part a specimen of *Cynoscion maculatum*, Garden's No. 2 (*Bairdiella*), and No. 5 (*Cynoscion maculatum*), both having probably been included under the name Yellow-Tail (Correspondence, page 312), and the description of color in *P. punctatus*, "Corpus lineis plurimis e punctis nigris," might have reference to the latter.

D. X, i, 24; A. I, 10.

Perca alburnus, L.

LINNÉ, Syst. Nat., ed. xii, 482.

The length of the typical specimen without caudal is 245^{mm}.

D. X, i, 24; A. I, 7; Scales 7—ca. 75—13.

The species is our *Menticirrus alburnus.*

Perca undulata, L.

LINNÉ, Syst. Nat., ed. xii, 483.

No. 8, Garden.

The length of the type to base of caudal is 220^{mm}.

D. X, i, 28; A. II, 8.

The species is *Micropogon undulatus.*

Perca ocellata, L.

LINNÉ, Syst. Nat., ed. xii, 483.

No. 39, Garden. The Bass.

The type of this species is 352^{mm} long to base of caudal.

D. X, i, 24; A. II, 8; scales 7–48–8.

In the annotated copy of edition xii Linné has written opposite this species, "*Sciæna*, Brouss."

Perca philadelphica, L.

LINNÉ, Syst. Nat., ed. xii, 484.

No. 14, Garden.

D. X, 11; A. III, 7; scales 7–53–15.

The lateral line has fifty-three scales to the base of the caudal; besides these there are five or six accessory scales extending upon the tail.

No. 2, Garden. Chub.

This seems to have been one of Linné's specimens of *Triloburus philadelphicus*=*Triloburus trifurcus.* It has D. X, 11; A. III, 7; scales 7–55–15.

Perca atraria, L.

LINNÉ, Syst. Nat., ed. xii, 485.

No. 14, Garden. "Black Fish."

The length of this type to caudal base is 191^{mm}. It is the southern form of the sea bass.

D. X, 11; A. III, 7; scales 6–45–13.

The description of *Perca atraria* is grossly inaccurate, but there is no doubt as to the species represented by the type.

Gmelin's description is almost entirely a paraphrase of Linné's, and it is not probable that he counted the rays at all.

Perca chrysoptera, L.

LINNÉ, Syst. Nat., ed. xii, 485.

No. 8, Garden. Sailor's Choice.

There are two half skins labeled (probably by Garden in reference to Catesby, plate ii) *Perca marina.* These appear to be Linné's types of *Perca chrysoptera*, which he has put on record as having been received

from Dr. Garden. They agree perfectly with Linné's description of *Perca chrysoptera.* The radial formula, strangely enough, is omitted. The species is the one long known to us as *Pristipoma fulvomaculatum.*

Additional arguments for its identity with this species is the persistence of the common name and the fact that the collection of Linné contains no *Hæmulons* from Garden.

The length of the larger type is 280^{mm} without caudal, and of the smaller 180^{mm}.

D. XII, 16; A III, 13; scales 10–75–17.

Perca guttata, L.

Linné, Syst. Nat., ed. xii, 485.

In the Linnæan Society collection is a half skin labeled *Perca guttata,* Linné. It is 240^{mm} in length without caudal; the height is contained $2\frac{3}{5}$ times and the head $2\frac{1}{2}$ times in this length.

D. XI, 16; A. III, 8.

This is evidently identical with a specimen in the National Museum, which was labeled *Epinephelus lunulatus* by Professor Poey.

Perca formosa, L.

Linné, Syst. Nat., ed. xii, 488.

No. 35, Garden.

The length of the type to the base of the middle caudal rays is 170^{mm}.

D. X, 12; A. III, 7.

The species has been known in our lists under the name of *Diplectrum fasciculare.*

Gasterosteus carolinus, L.

Linné, Syst. Nat., ed. xii, 490.

No. 8, Garden. The Crevallèe.

This is the type of the present *Trachynotus carolinus.* It is 190^{mm} in length to caudal base; in this length the height is contained twice, and the head three and one-half times.

D. VI, i, 26; A. II, i, 23.

Gasterosteus canadus, L.

Linné, Syst. Nat., ed. xii, 491.

No. 7, Garden.

The type of this species, marked number 7 in Garden's handwriting, and "*Gasterosteus*" in that of Linné," is 328^{mm} in length to caudal base. It is referred to by Garden (Correspondence, 312) as having no English name.

The species is now known as *Elacate canada.*

Scomber hippos? L.

Linné, Syst. Nat., ed. xii, 494.

A specimen of a *Caranx,* No. 16, apparently referred to in the Correspondence with Linné, page 312, is labeled by Linné *Scomber chrysurus.*

It is not, however, the *Scomber chrysurus*, ed. xii, 494, but it is the *Caranx hippus* of Jordan & Gilbert, Bull. 16, U. S. National Museum, pages 437, 438, and agrees, except in the count of the anal, with *Scomber hippos*, Linné, ed. xii, 494.

The specimen is 220^{mm} long to end of scutes, and has the following characters:

D. VIII, i, 20; A. II, i, 16; scutes 31.

Opercular spot large; breast naked, except a small patch in front of ventral; curved portion of lateral line as long as the head. Third dorsal spine a little more than one-third length of head. Eye one-fourth as long as head; head one-third of total to origin of rudimentary caudal rays; maxilla one-third height of body; mandible almost one-half length of head.

Scomber chrysurus, L.

LINNÉ, Syst. Nat., ed. xii, 494.

This species is represented by four type specimens, ranging in length from 95 to 150^{mm} to caudal base.

There are two spines in front of and somewhat remote from the anal.

D. VIII, i, 28; A. II, I, 27.

The species is *Chloroscombrus chrysurus.*

Trigla evolans, L.

LINNÉ, Syst. Nat., ed. xii, 498.

No. 21, Garden.

The type of *Trigla evolans* is 90^{mm} long to base of caudal, and has the following characters:

D. X., 12; A. 12. There seem to be about fifty tubes in the lateral line (sixty or more rows of scales).

The length of the head is contained about $2\frac{1}{5}$ times in the total without caudal. The eye is $\frac{2}{9}$ as long as the head. There is no trace of a furrow behind the eyes, and there are no dark lines at present along the sides. The spines of the head do not appear nearly as much developed as in young *P. tribulus.* The spine at the angle of the preoperculum is not quite so long as the eye, and has a small spine at its base. The opercular spine measuring back to the beginning of the ridge is about as long as the orbit. The length of the maxilla is $\frac{1}{6}$ of the total without caudal. The pectoral reaches to the sixth anal ray.

Cobitis heteroclitus, L.

LINNÉ, Syst. Nat., ed. xii, 500.

No. 11, Garden. "Anonymos."

See page 305, volume i, Smith's Correspondence of Linné. The editor of this volume has evidently been misled by the common name "mud-fish," in referring number eleven to *Amia calva*, which was number 4 of a later lot. (See page 312.)

The above example was apparently the type of Linné's description of *Cobitis heteroclitus.* In the annotated copy of edition xii, Linné wrote

that it was referred to a new genus, "*Borborys*," by Broussonet, with the following characters: "Corpus squamosum. Pinn. dorsi unica. Maxill. infer. intr. carin. Caput squamosum."

We have not been able to ascertain whether or not Broussonet has published a description of this genus.

The skin is 122^{mm} long. The head is one-fourth of the total length without caudal, and the depth about the same.

D. 12; A. 10. Scales in 33 longitudinal and 12 transverse rows.

A black blotch is still apparent on the posterior part of the dorsal.

The species is now known to us as *Fundulus heteroclitus.*

Amia calva, L.

LINNÉ, Syst. Nat., ed. xii, 500.

There being no doubt concerning this species, we have merely to say that the length of the type to caudal base is 285^{mm}.

Silurus felis, L.

LINNÉ, Syst. Nat., ed. xii, 503.

No. 19, Garden.

The length to base of caudal is 270^{mm}.

D. I. 8; A. 23.

The species is, of course, the one now known as *Arius felis.*

Teuthis hepatus, L.

LINNÉ, Syst. Nat., ed. xii, 507.

The length of the type is 208^{mm} to caudal base. The height of the body equals nearly two-thirds of this length; the length of the head is contained $3\frac{2}{3}$ times in the total without caudal; the eye is one-fourth as long as the head. The least height of the tail is contained 9 times in total without caudal, the longest dorsal spine $6\frac{1}{2}$ times. The longest anal spine is one-half as long as the head. There are 7 teeth on a side in each jaw.

D. IX, 26; A. II, 25; V. I, 5.

Esox osseus, L.

LINNÉ, Syst. Nat., ed. xii, 516.

No. 9, Garden.

The species is our well-known *Lepidosteus osseus.*

Elops saurus, L.

LINNÉ, Syst. Nat., ed. xii, 518.

The type of this species is a half skin cut in two pieces, pasted one above the other. The length to caudal base is 460^{mm}.

D. 24; A. 16.

In the margin of the annotated copy Linné has written: "Forsk. Tr. Orient, p. 68, No. 100."

The reference to Brown, Jamaica, 452, 2, is stricken out.

Mugil albula, L.

LINNÉ, Syst. Nat., ed. xii, 520.

The length of the typical example is 290^{mm} without caudal. There are forty scales in a longitudinal series, and thirteen in a transverse series. At least two scales seem to be absent from the end of the lateral line.

Anal III, 8.

There seems to be no doubt that this is the species which is known to recent writers as *Mugil albula.*

Clupea thrissa, L.

LINNÉ, Syst. Nat., ed. xii, 524.

Two skins labeled by Linné "*Clupea thrissa* e Carolina" are *Dorosoma cepedianum.* Upon the strength of these specimens referred, in edition xii, 524, to *C. thrissa*, the name *thrissa*, evidently not based upon Brown's meager data, Nat. Hist. Jam., 443, but upon the notes of Lagerström and Osbeck, has been attached to our American *Opisthonema.* The specific name *thrissa*, which has been applied since the time of Broussonet, 1782, to fishes of the *Opisthonema* type, properly belongs to some Chinese form, perhaps some member of the genus *Dorosoma.*

The description given by Linné, x, 318, is based upon the descriptions of three previous authors—Brown, Nat. Hist. Jam., 443, whose few words do not constitute a description from which the fish seen by him can be identified; Odhelius, who, in his Chinense Lagerströmiana, gave a partial description,* with radial formulæ from which Linné borrowed his count of anal rays in his description, and which may possibly apply to Richardson's *Chatoëssus maculatus ;* and Osbeck's Dagbok öfver en Ostindisk Resa, &c., Stockholm, 1757, 257, the description in which is moderately full, and may apply to the *Chatoëssus punctatus*, Schlegel, of China and Japan.

As already stated, the specimens sent by Garden to Linné, which the latter provisionally referred (edition xii, 524) to *C. thrissa*, are *Dorosoma cepedianum.*

Broussonet was the first to make a definite assignment of the Linnean name to the American form, of which he had seen specimens from Carolina collected by Dr. Blagden, and from Jamaica collected by J. Ellis, the latter in Mus. Banks. And of this form he published a good description and figure, Ichth. Decas , i, penultimate species, with plate following.

The first description of the *Opisthonema* of the Western Atlantic appears to have been that of Lesueur, Jour. Acad. Nat. Sci., Phila., i, 1817, page 359, under the name *Megalops oglina.* If this be correct the species must be called *Clupea* (or *Opisthonema*) *oglina.*

Cyprinus americanus, L.

LINNÉ, Syst. Nat., ed. xii, 530.

There are two types of *Cyprinus americanus*, and the paper on which they are fastened is labeled by Linné.

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*Amœn. Acad., iv, 1759, 251.

The larger of the two measures 145^{mm} to caudal base, and the smaller 108.

In the annotated copy of edition xii, Linné has added the words "linea laterali curva."

D. 9; A. 17–18, besides a minute one in front; V. 9; scales 10—46 or 47—3½, or 4½.

The dorsal base is ½ as long as the head. The fourth ray of the dorsal is as long as the head. The head is two-ninths of the total length to caudal base. The eye is as long as the snout, and about one-fourth as long as the head. The anal base is nearly as long as the head and nearly one-fifth of the length to caudal base. The fourth anal ray is as long as the ventral. The length of the ventral equals one-half the height of the body at the dorsal origin. The species is the southern form of *Notemigonus americanus.*

Hæmulon arcuatum, C. & V.

There is in the Linnæan collection a specimen of *Hæmulon arcuatum* from the Bahamas, which was sent to Linné by Garden in 1771, under the name Marget Fish (No. 3 of list in Smith's "Correspondence," page 331), and which appears never to have been described by Linné.

This is probably the Margate Fish of Catesby, plate 2, figure I, although this figure is without the blue stripes upon the cheeks. Catesby's plate 6, figure 1, should probably be referred to another species (*Hæmulon elegans*).

The skin has: D. XII, 18; A. III, 9; Scales 6–49–14.

The attempt to saddle upon this fish the name *Labrus plumieri*, which has been made ineffectually since the time of Lacépède, might as well be abandoned. Plumier's painting labeled *Turdus aureo-cœruleus*, reproduced in Lac., t. 3, pl. 2, page 84, fig. 2, and the description derived from this figure upon page 482 of the same work, have no relation to any known species of fish which has yet been satisfactorily demonstrated. Cuvier and Valenciennes were misled by Linné's course in citing Catesby, plate 6, fig. 1, in connection with his description of the Squirrel Fish, which he received from Garden, and which he named *Perca formosa.* This is evidently the species so long catalogued by American ichthyologists under the name *Diplectrum fasciculare.*

Plate 6, of Catesby, upper figure, appears to represent the type of the species described later by Cuvier and Valenciennes under the name *Hæmulon elegans.*

Hæmulon sciurus, Shaw.

This species is represented in the Linnæan collection by a bad half skin, apparently the No. 4, "Yellow Grunt" of Garden's list ("Correspondence," page 331), and corresponding to Catesby, plate 6, figure I. The figure, however, does not represent the stripes upon the sides, which are still evident in the Linné skin.

The dorsal spines are not all present.

Second dorsal, 16; A. III, 9; Scales 7–55–14.

Linné never named this form.

Stelliferus lanceolatus, Holbrook.

A specimen apparently of this species, labeled "No. 13" by Garden (not No. 13 of "Correspondence," p. 313), is in the collection, but was never described by Linné.

Archosargus probatocephalus, (Walb.) Gill.

A small specimen labeled as below by Garden is the species now called *A. probatocephalus:*

No. 15.
SPARUS *species.*
Nostralibus
SHEEPSHEAD.

It does not appear to have been named by Linné, owing, perhaps, to mutilation. The persistence of the common name is worthy of note.

Micropterus salmoides, Lac.

Linné had two examples of the large-mouth black bass from Garden (Nos. 8 and 40 Garden), but he does not seem to have described the species.

For No. 8, see Correspondence with Linné, 311; for 40, see p. 306.

No. 40 is labeled thus by Garden:

No. 40.
LABRUS.
Nostralib.
FRESH-WATER TROUT.

Clupea vernalis, Mitchill.

A species labeled by Garden "No. 4 Clupea" is in the collection. No allusion is made to it by Linné or in Garden's Correspondence.

NOTE ON EPINEPHELUS NIGRITUS.

By **DAVID S. JORDAN.**

In the fish market at Indianapolis, I examined, recently, a large black "jew-fish" (*Epinephelus nigritus*, Holbrook) from near Pensacola.

The following are some of the characters shown by this specimen:

Length 5 feet. Anal rays III, 9.

Second dorsal spine longest, its length $2\frac{1}{4}$ times in head, and half longer than the third spine. Interorbital width $4\frac{1}{3}$ in head; maxillary about 2 in head. Eye small. Preopercle without salient angle or enlarged teeth. Top of head not broad, nor especially depressed. Caudal fin very slightly lunate, the angles rounded. Scales of lateral line of the ordi-

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nary type, color plain blackish gray, without markings, the lower parts scarcely paler; no reddish shades.

Few specimens of this species have been studied, and only one has been recorded of less than 100 pounds weight, so far as I remember.

It is evident that this species has no special relation to the Great Jewfish or Guasa (*Promicrops itaiara*). Its nearest relations seem to be with *Epinephelus morio.* Not having seen specimens of the two at all similar in size, it is hard to decide as to how near these relations are. The most obvious differences are in color, in the more robust form of *E. nigritus*, and in the much greater concavity of the caudal in *E. morio.*

Dr. Bean, who has examined the young of *E. nigritus*, regards it as very distinct from the young of *E. morio.*

INDIANA UNIVERSITY, *April* 1, 1885.

DESCRIPTION OF A NEW SPECIES OF AMBLYSTOMA (AMBLYSTOMA COPEIANUM) FROM INDIANA.

By O. P. HAY.

The specimen on which the following description is based was found dead and somewhat mutilated. The injury that it has suffered does not, however, in any way obscure the characters of the species, amounting, as it does, only to a loss of the entire left fore-limb and slight fractures of a few of the bones of the anterior part of the head.

The head is large, somewhat wider than the body, and flattened; the body short, and the tail long and compressed. The skin is, for the most part, smooth, but everywhere, as seen under a lens, is pitted with the openings of the cutaneous follicles. Of these, there are a few enlarged ones in a band surrounding the orbit and extending forward to the nostril. Others are found above the angle of the jaw, and a few still larger ones on the posterior border of the parotid region. The prominent keel, and the whole tip of the tail are so richly provided with enlarged pores as to present a granulated appearance.

The width of the head is somewhat greater than that of the body. It is possible that the breadth and flatness of the head have been exaggerated somewhat by the injuries that it has received; but this can be true only to a very slight extent. The breadth is about the same at the angle of the jaw and the corner of the mouth. From the former point the head tapers backward, the outline being concave to its posterior border, where it is suddenly constricted into the neck. From the corners of the mouth the head tapers forward to nearly opposite the nostrils, beyond which it is rapidly rounded to form the snout. The width of

the head is a little less than the distance from the snout to the gular fold; and is contained in the distance from the snout to the groin three and six-tenths times. The distance to the gular fold is contained in the distance to the groin three and two-tenths times. The depth of the head, on a line joining the angles of the jaws, is a little less than one-half its width. The gular fold does not overlap, as it does in some species. It may have done so in life, but manipulation of the skin fails to restore an overlapping fold. The upper jaw projects beyond the lower. Eyes of moderate size. External nares small; their distance apart somewhat less than the width of the interorbital space.

The tongue is not notably different from that of *A. tigrinum*. The teeth are arranged in four series, which together form an inverted V, the angle of which is very obtuse. The limbs of the V, as seen with the unaided eye, appear nearly straight, and are seen to extend beyond the internal nares along their external fissure. Examination with a lens proves that the inner series are each slightly ~ shaped and so disposed as to make the angle of the V rounded off. The outer series on each side is nearly as long as the corresponding inner series, is plainly separated from it, and nearly straight or slightly concave on the posterior side. Inner nares more distant than the external. The body is somewhat depressed, but has not the swollen appearance presented by *A. opacum*. The distance from the snout to the axilla is just equal to that from the axilla to the groin. There are eleven well-marked costal grooves. There is a median furrow, not deep but distinct, beginning on the occiput and running along the back, deepening on the sacral region and ending over the middle of the vent at the commencement of the caudal crest. The cloacal region is considerably swollen and is broad and rounded, or slightly emarginate, behind. The distance from the groin to the posterior end of the vent in this species is greater proportionally than in any other of the genus, so far as I have been able to determine. It is contained in the distance from the snout to the groin but three and one-sixth times.

The tail is equal in length to the distance from the snout to the beginning of the vent. It is much compressed and rather high. It has a well-developed keel, or crest, which begins immediately over the cloaca and extends to the tip of the tail. The keel is sharp above and is bounded below, on each side, by a shallow groove. Inferiorly the tail is broadly rounded for its anterior third or more, and is traversed by a median longitudinal groove. The remainder of its lower border is compressed to a sharp edge. A transverse section of the tail, taken just behind the cloaca, would form approximately an isosceles triangle whose base would be about one-half its height. One-third of the distance back toward the tip the height of the tail is three times its thickness.

The limbs are well developed. The posterior are a little longer, somewhat stouter, and the foot broader than the same limbs of a specimen of *A tigrinum* that measures the same distance from the snout to the

end of the vent. They are also fully as long as the same limbs of a specimen of *A. punctatum* that measures from snout to the end of the vent three-fourths of an inch more than the specimen I am describing. The toes are much like those of *A tigrinum*, perhaps not so broad, while they are not so slender as those of a specimen of *A. punctatum* now before me. They are provided with a narrow marginal and basal membrane. There are two distinct plantar tubercles.

Measurements.

	Inches.	Lines.
Length:		
From snout to end of tail	5	8
From snout to gular fold	0	8.5
From snout to line joining axillæ	1	1.5
From snout to groin	2	3
From snout to end of vent	3	0
From end of vent to tip of tail	2	8
From axilla to groin	1	1.5
From groin to end of vent	0	8.5
Width of head at angle of jaw	0	7.5
Distance between anterior canthi	0	4.6
Interorbital space	0	3.25
Greatest height of the tail	0	5
Thickness of tail at highest point	0	2
Length of whole fore-leg	0	11
Lower arm and hand	0	7.5
Length of third finger	0	2.5
Hinder limb, total length	1	0.05
Lower leg and foot	0	9
Free portion fourth toe	0	3
Expanse of outstretched hinder limbs	2	5
Distance between external nares	0	2.6
Distance between inner nares	0	3.6

Proportional dimensions.

	Times.
Muzzle to gular fold:	
In distance from snout to groin	3.2
In distance to end of vent (nearly)	4.2
Fore-arm and foot:	
In distance to groin	3.6
In distance to end of vent	4.7
Lower leg and foot:	
In distance to groin	3
In distance to end of vent	4
Width of head:	
In distance to groin	3.6

The color is dark brown, almost black, above, brownish-yellow below. Between the fore and hind legs the light color of the belly mounts up on the sides to a level with the upper surfaces of the limbs. The middle of the belly is of a duskier hue than its sides. Pectoral, inguinal, and pubic regions slightly brighter yellow than the sides of the belly. Head above like the back, below like the other lower parts. Just

behind the symphysis of the lower jaw are indications of a bright yellow spot. The upper half of the tail is not so dark as the back, the lower half duskier than the belly. The limbs below and in front yellowish, as other lower parts. Feet, especially above, dark. This species must be compared with *A. bicolor*, *A. tigrinum*, and possibly with *A. obscurum*. The last two belong to the group which has twelve costal grooves, as the species are arranged in Prof. E. D. Cope's "Review of the Amblystomidæ" (Proc. Acad. Nat. Sci. Phila., 1867, 166). *A. obscurum* has the internal nares no more widely separated than are the outer; the limbs of the palatine V are decidedly concave, and the inner series of teeth are about twice the length of the outer. The frontal region of *A. obscurum* is also said to be very convex. It is also a rather long-bodied species, the distance from the snout to the axilla being contained in the distance from the snout to the [groin] nearly two and four-tenths times, while in *A. copeianum* the latter distance is but twice the former. Indeed, this form differs from all others, so far as my knowledge extends, in this equality of the distances from snout to axilla and from axilla to groin. *A. bicolor* approaches it most nearly. In such specimens of *A. tigrinum* as I have been permitted to examine, the ratio of the two dimensions is about the same as given above for *A. obscurum*. It is about the same in specimens of *A. mavortium*, as deduced from measurements given in Professor Cope's paper cited above. From *A. tigrinum* my species differs further in having no traces of the yellow spots so characteristic of that common form. *A. copeianum* has also a broader and more depressed head, a more compressed tail, and longer limbs.

A. bicolor is described as having the palatine teeth in three entirely transverse series; as having a very short muzzle, and as being more or less spotted. A comparison of some of the dimensions of the two species is necessary. The type of *A. bicolor* now in the museum of the Academy of the Natural Sciences of Philadelphia furnishes the measurements found in the first column, which are taken principally from Professor Cope's paper. Those marked with an asterisk have been kindly obtained for me by Prof. Angelo Heilprin. It is almost exactly the size of the type of *A. copeianum*, 5 inches 10.05 lines.

Measurements.	A. bicolor.		A. copeianum.	
	In.	*Lin.*	*In.*	*Lin.*
Length from snout to gular fold	0	9.75	0	8.5
Length from snout to axilla	*1	2.5	1	1.8
Length from snout to groin	2	7.2	2	3
Length from snout to end of vent	3	2.3	3	0
Length axilla to groin	*1	4.5	1	1.15
Length lower leg and foot		8.8		9
Width of head		8.75		7.5
	Times.		*Times.*	
Fore-arm and foot into distance snout to groin		4.6		3.6
Lower leg and foot into distance snout to groin		3.54		3
Whole anterior limb into distance snout to groin		*$3\frac{1}{3}$		$2\frac{5}{11}$
Whole anterior limb into distance snout to vent		*$4\frac{1}{8}$		$3\frac{3}{11}$

The above table of comparative measurements shows that *A. bicolor* has, in comparison with *A. copeianum*, a longer and still broader head; in spite of this a distance from the axilla to the groin greater than that from the snout to the axilla, a much shorter pelvic region and shorter fore and hind limbs.

Found at Irvington, near Indianapolis, April 7, 1885, by one of my students, Mr. George H. Clarke.

The species is dedicated to Prof. E. D. Cope, herpetologist and palæontologist. It is represented on Plate XIV of this volume.

IRVINGTON, INDIANA, *May* 5, 1885.

LIST OF PLANTS COLLECTED BY MR. CHARLES L. McKAY AT NUSHAGAK, ALASKA, IN 1881, FOR THE UNITED STATES NATIONAL MUSEUM.

By **FRANK H. KNOWLTON.**

The plants enumerated in the following list were collected during the spring and summer of 1881 by Mr. Charles L. McKay, of the United States Signal Service, stationed at Nushagak, Fort Alexander, Alaska. The collection, although small in point of numbers, contains several species of extreme interest, and adds also a few to the flora of Alaska. Nothing like an exhaustive collection was made, owing, of course, to lack of sufficient time, and we remark the absence of many well-known genera, *e. g.*, *Draba*, *Saxifraga*, *Aster*, &c.

In passing it is a pleasure, as well as an act of justice, to record the highly satisfactory manner in which this collection was made, a fact quite at variance with the generality of such itinerant collecting. The greatest care was taken to fully represent every species, which, as in the case of the species of *Salix*, often necessitated visiting the same locality several times. It is to be regretted deeply that science lost by the untimely death of Mr. McKay (he was drowned by the unfortunate overturning of his boat, on April 19, 1882), one so well fitted to do thorough work.

I wish to acknowledge my great indebtedness in the preparation of this list to Prof. Lester F. Ward, of the National Museum; Dr. George Vasey, of the Department of Agriculture; and Mr. M. S. Bebb, of Rockford, Ill.

In the arrangement of families and genera, Bentham and Hooker's "Genera Plantarum" has been exclusively followed. In the arrangement of species, the various publications of Dr. Asa Gray have been followed where available.

RANUNCULACEÆ.

Thalictrum sparsiflorum, Turcz.

Island above tide-water in the Nushagak River. June 25.

Anemone alpina, Linn.

In vicinity of Nushagak. June 9.

Ranunculus Cymbalaria, Pursh, var. **alpinus**, Hook.

Bear Creek. August 14.

Ranunculus Purshii, Richards.

Near the mouth of Lake Allokuagik. August 24.

Ranunculus Lapponicus, Linn.

Near Poplar Grove, south of Nushagak. June 20.

Ranunculus repens, Linn.

In flower along the Nushagak River, 40 miles above Nushagak, June 26. In fruit near the mouth of Lake Allokuagik, August 24.

Catha palustris, Linn., var. **Sibirica**, Regel. (*C. palustris*, L., var. *asarifolia*, in Rothrock's Sketch of the Flora of Alaska.)

June 22.

Aconitum Napellus, Linn., var. **delphinifolium**, Seringe.

Immediate vicinity of station. July 27.

CRUCIFERÆ.

Nasturtium palustre, DC.

Common about Nushagak. In flower July 27.

Barbarea vulgaris, R. Br.

Nushagak River, 40 miles above station. June 25.

Arabis ambigua, DC.

"The Lake." June 16.

Cardamine pratensis, Linn.

Ten miles above Nushagak. June 23.

VIOLACEÆ.

Viola Langsdorffii, Fisch.

June 4.

CARYOPHYLLACEÆ.

Cerastium alpinum, L., var. **Behringianum**, Regel. (*C. vulgatum*, L., var. *Behringianum*, Rothr., Fl. Alask.)

Near the mouth of Lake Allokuagik. August 24.

Cerastium alpinum, L., var. **Fischerianum**, Torr. & Gray. (Probably *C. vulgatum*, L., var. *grandiflorum* of Rothr. Fl. Alask.)

Island above tide water in Nushagak River. June 25.

Stellaria longipes, Goldie.

In flower June 20.

Stellaria media, Smith.

August 3.

Stellaria borealis, Bigelow.
August 3.

Arenaria lateriflora, Linn.
June 20.

Arenaria arctica, Stev.
Bristol Bay, above Nushagak. July 21.

PORTULACACEÆ.

Montia fontana, Linn.
August 3.

GERANIACEÆ.

Geranium erianthum, DC.
About Nushagak. In flower June 21.

LEGUMINOSÆ.

Lupinus perennis, Linn.
Allokuagik Lake. August 5.

Lupinus Nootkatensis, Doon.
In flower June 22.

Lathyrus maritimus, Bigel.
In flower June 21.

Lathyrus palustris, Linn.
Specimens with only two pairs of leaflets. In flower July 27.

ROSACEÆ.

Spiræa betulifolia, Pallas.
July 27.

Rubus arcticus, Linn.
A single specimen only, without date or locality.

Rubus Chamæmorus, Linn.
In vicinity of station. June 4 and 8.

Potentilla Anserina, Linn.
A very large form from vicinity of station, collected August 3, and a small form from Bear Creek, collected August 14.

Potentilla palustris, Scop.
July 27.

Poterium Canadense, Benth. & Hook.
Near the station. July 27.

Pyrus Americana, DC.
Poplar Grove. In flower July 28.

SAXIFRAGACEÆ.

Chrysosplenium alternifolium, Linn.
No date or locality.

Parnassia palustris, Linn.
Allokuagik Lake. August 5 and 9.

Ribes laxiflorum, Pursh.
About Lake Allokuagik. June 4.

ONAGRACEÆ.

Epilobium alpinum, Linn.
A very large form. July 27.

Epilobium palustre, Linn.
July 27.

Epilobium affine, Brong.
A single specimen only. July 27.

Epilobium angustifolium, Linn.
In fruit. July 27.

Epilobium tetragonum, Linn.
July 27.

Epilobium luteum, Pursh.
Allokuagik River. August 23.

UMBELLIFERÆ.

Selinum Benthami, Watson. (*Conioselinum Fischeri*, Wimm. & Grab, of Rothr. Fl. Alaska.)
Vicinity of Nushagak, in flower. In fruit July 27.

Archangelica officinalis, Hoff.
July 27.

CORNACEÆ.

Cornus Canadensis, Linn.
Common about the station. June 28.

CAPRIFOLIACEÆ.

Sambucus racemosus, Linn. (*S. pubens*, Mx.)
Allokuagik River. Leaves only. Aug. 24.

Viburnum acerifolium, Linn.
June 28.

Viburnum pauciflorum, Pylaie.
June 20.

Linnæa borealis, Gronov.
In flower. July 27.

RUBIACEÆ.

Galium boreale, Linn.
July 28.

VALERIANACEÆ.

Valeriana capitata, Pallas.
In vicinity of Nushagak. June 23 and June 28.

COMPOSITÆ.

Solidago multiradiata, Aiton. (*S. virga-aurea*, Linn., var. *multiradiata*, in Rothr. Fl. Alaska.)
Poplar grove, near Nushagak. July 28.

Erigeron salsuginosus, Gray. (*Aster salsuginosus*, Richards. Rothr. Fl. Alaska.)
Near the mouth of Lake Allokuagik. August 24.

Achillea Millefolium, Linn.
Common about the station. July 27.

Chrysanthemum arcticum, Linn. (*Leucanthemum arcticum*, DC. Rothr. Fl. Alaska.)
August 9.

Matricaria discoidea, DC.
August 3.

Artemisia Norvegica, Fries, var. **Pacifica**, Gray. (*A. Chamissoniana*, Bess. Rothr. Fl. Alaska.)
July 27.

Artemisia vulgaris, Linn., var. **Tilesii**, Ledeb.
August 9.

Petasites frigida, Fries. (*Nardosmia frigida*, Hook. of Rothr. Fl. Alaska.)
June 4.

Senecio Pseudo-Arnica, Less.
Nushagak. July 27.

VACCINIACEÆ.

Vaccinium uliginosum, Linn.
No date given.

Vaccinium Vitis-Idæa, Linn.
Nushagak. June 20. In flower.

ERICACEÆ.

Andromeda polifolia, Linn.
The collection contains a good number of specimens of this species. In flower June 8, 10, and 14.

Loiseleuria procumbens, Desv.
June 14.

Ledum palustre, Linn.
June 20.

Pyrola rotundifolia, Linn.
Poplar Grove. July 28.

PRIMULACEÆ.

Trientalis Europæa, Linn., var. **arctica**, Ledeb.
Not dated.

GENTIANACEÆ.

Pleurogyne rotata, Griseb.
Bear Creek, above Nushagak. August 14.

Menyanthes trifoliata, Linn.
Nushagak River, 50 miles above the village. June 25.

POLEMONIACEÆ.

Polemonium cæruleum, Linn.
Ten miles above Nushagak. June 23.

BORRAGINACEÆ.

Mertensia paniculata, Don.
Fifty miles above Nushagak. June 25.

SCROPHULARIACEÆ.

Mimulus luteus, Linn.
July 27.

Pedicularis euphrasioides, Stephan.
No date or locality given.

Pedicularis Sudetica, Willd.
June 20.

Pedicularis Langsdorffii, Fisch., var. **lanata**. (*P. lanata*, Willd.)
June 20.

Rhinanthus Crista-galli, Linn.
July 27.

LENTIBULARIACEÆ.

Pinguicula villosa, Linn.
Near Nushagak. June 28.

POLYGONACEÆ.

Polygonum aviculare, Linn.
About the station, no date given.

Rumex longifolius, DC. (*R. domesticus*, Hart. of Rothr. Fl. Alaska.)
No date or locality.

CUPULIFERÆ.

Betula nana, Linn., var. **glandulosa**. (*B. glandulosa*, Michx.)

After a careful examination of a considerable suit of specimens, I am convinced that there is no clear line of demarcation between the *B. nana* of Europe and the so-called *B. glandulosa* of American authors. Among a set of specimens of typical *B. nana* from various parts of Europe a few have slightly glandular branches, and a full suit of *glandulosa* show considerable variation in this respect also. In the characters of the aments and fruits they seem to grade into each other.

In flower June 10.

Betula occidentalis, Hook.

A fine set of specimens, both in flower and fruit. In flower June 9, along the river six miles above Nushagak; in fruit August 23, at the mouth of the Allokuagik River.

Alnus viridis, DC.
Immature flower. June 4 and 8.

SALICINEÆ.

(Identified by Mr. M. S. Bebb.)

Salix glauca Linn.

Poplar grove, three miles south of Nushagak. June 20.

Salix speciosa, Hook. & Arn.

June 14.

Salix fulcrata, And., var. **subglauca**, And. (*S. phylicoides*, And. in part.)

This is an extremely rare and interesting species, now thought to be represented for the first time in American herbaria. Mr. Bebb writes of it as follows: "It is precisely like Seeman's specimen in Herb. Kew. Upon this, almost wholly, Anderson founded his *S. phylicoides* (Sal. Bor. Amer.) excepting a variety *angustifolia*. Subsequently in his 'Monographia Salicum' he transfers what was before clearly the type of his species to *S. fulcrata*, and makes the before scarcely noticed var. *angustifolia* the all in all of his *S. phylicoides*. In this change the variety and not the *type* should have been eliminated. But here comes in another question. The first publication was in a comparatively obscure paper, the latter one is sanctioned in the author's 'Prodromus Monographia,' and is known the world over." The present specimens consist of both male and female aments and perfect leaves.

Collected near Nushagak. June 8 and 14.

Salix crassijulis, Trev. & Traut.

June 20.

Populus balsamifera, Linn.

Flowers June 8, fruit August 12.

CONIFERÆ.

Picea alba, Link. (*Abies alba*, Michx.)

Mouth of Allokuagik River. August 23.

ORCHIDACEÆ.

Habenaria obtusata, Richardson. (*Platanthera obtusata*, Lindl. in Rothr. Fl. Alaska.)

Near station. June 28.

Corallorhiza innata, R. Br.

Near station. June 28.

IRIDEÆ.

Iris Sibirica, Linn.

June 28.

LILIACEÆ.

Streptopus amplexifolius, DC.

Poplar grove. July 28.

Fritillaria Kamtschatensis, Fisch.

Near Nushagak. June 22.

JUNCACEÆ.

Luzula arcuata, Meyer.

June 20.

Luzula spadicea, DC., var. **parviflora**, Ledeb. (*L. parviflora*, Desv., var. *melanocarpa*.)

No date of collection given.

CYPERACEÆ.

(Identified by Dr. George Vasey.)

Eriophorum Scheuchzeri, Hopp. (*E. capitatum*, Host., *E. Chamissonis*, C. A. M.)
Immature. June 14.

Carex atrata, Linn.
In flower only. June 28.

Carex cryptocarpa, Meyer.
June 20.

Carex Gmelini, Hook.
Probably this species, but too young. June 14.

Carex rigida, Boott.?
In flower only. June 8.

GRAMINEÆ.

(Identified by Dr. George Vasey.)

Phleum alpinum, Linn.
Island above tide-water in Nushagak River. June 25.

Sporobolus arundinaceus, Vasey. (*Vilfa arundinacea*, Trin.)
July 27.

Agrostis scabra, Linn.
July 28.

Deyeuxia Langsdorffii, Kunth.
July 18.

Deschampsia cæspitosa, Beauv. (Aira of authors.)
Specimens collected July 28 and August 3.

Trisetum subspicatum, var. molle, Gr.
No date of collection.

Poa cenisia, All. (*P. arctica*, R. Br.)
Island above tide-water in Nushagak River. June 25. Near station. June 21.

Poa glumaris, Trin.
No date of collection.

Graphephorum pendulinum, Gr. (*Arctophila Loestadii*, Rupt. *A. pendulinum*, And.)
August 9.

Festuca scabrella, Torr.
June 28.

Elymus mollis, Trin.
July 11.

Hordeum nodosum, Linn. (*H. pratense*, Huds.)
August 31.

EQUISETACEÆ.

Equisetum sylvaticum, Linn.
June 4.

LYCOPODIACEÆ.

Lycopodium annotinum, Linn.

July 28.

FILICES.

Phegopteris Dryopteris, Fée.

July 28. Near station.

Aspidium spinulosum, Swartz.

Mouth of Allokuagik River. August 23.

Asplenium Filix-fæmina, Bernh.

July 27.

MUSCI.

Sphagnum, species.

Near station. August 12.

Polytrichum gracile, Menz.

August 9.

Polytrichum strictum, Banks. (*P. juniperinum*, Willd., var. *strictum*.)

Abundant about station. June 10.

Hypnum, species.

Specimens without fruit. Allokuagik River. August 24.

LICHENS.

"**Cladonia gracilis** (L.) Nyl, var. **elongata**, Fr. *forma macroceras*." Edward Tuckerman (in litt.)

Allokuagik River. August 24.

NATIONAL MUSEUM, *June* 1, 1885.

THE GENERIC NAME OF THE PASTINACAS, OR "STING-RAYS."

By S. GARMAN.

Dasybatus Klein, 1742, Ichthyol., Miss., iii, 34.
Walbaum, 1792, Artedi Gen. Pisc., 581.
Walb., 1793, Kleinii Ichthyol. Enod., 35.
Jordan, 1881, Pr. U. S. Mus., 35.
Dasyatis Rafinesque, 1810, Car. Gen., 16.
Raf., 1810, Ind. d'Ittiol. Sicil., 49.
Raf., 1815, Annal. Nat., 93.
Jord., 1883, Bull. 16, U. S. Mus., 47.
Trygonobatus Blainville, 1816, Bull. Soc. Philom., 112.
Trygon (Adans.) Cuvier, 1817, R. Anim., ii, 136,—1829, ii, 399.
Geoffroy, 1817, Descr. Egypt, Poiss., plates.
Eichwald, 1819, De Selachis Aristotelis, 55.
Risso, 1826, Hist. Nat., iii, 160.
Geoffroy, 1827, Descr. Egypt, Poiss., 332, 333.
Bonap., 1832–'41, Fauna Ital., Pesci.
Müller & Henle, 1838, Ann. Mag. N. H., 90,—1841, Plagiost., 158.

Trygon Agassiz, 1833–'43, Poiss. Fossiles, iii, 382**.
Adanson, 1844–'45, Cours d'Hist. Nat., ii, 170.
Duméril, 1865, Hist. Nat. Poiss., i, 582.
Günther, 1870, Cat., viii, 472.
Gill, 1873, Fish. E. Coast N. Amer., 34.
Goode & Bean, 1879, Fishes of Essex Co., Mass., 29.
Garman, 1880, Bull. Mus. Comp. Zool., 170.
Jord., 1883, Bull. 16, U. S. Mus., 879.
And others.
Dasybatis Jord., 1880, Pr. U. S. Mus., 31.
Dasibatis Garm., 1883, in Jord. Bull. 16, U. S. Mus., 65.

Dasybatus, 1742, 1792, 1793, 1810.

By Klein, in 1742, this name was applied to one of the Pastinacas. This fact alone would not demand attention here if it were not for republication and references to Klein's works since the appearance of the tenth edition of Linné's Systema. Besides the first species, a Ray—the type of the genus under consideration—Klein had placed under the name a number of Skates. His genus is not on this account to be regarded as a synonym for *Raja* of Linné. That genus included as first established all that Klein had placed in four genera: *Narcacion*, *Rhinobatus*, *Leiobatus*, and *Dasybatus*. The first two of these latter have been generally accepted, though the name *Narcacion* (1742, 1792, 1793) has been dropped for *Torpedo* (1806).

Walbaum's use of *Dasybatus* in 1792, and again in 1793, does away with the objections to the name on account of its early date of publication by Klein. The real reason Klein's work received so little attention lies in its lack of accord with the binomial system. Accepting this as sufficient cause for putting aside its specific designations, we still have to deal, in the cases of his genera, with Walbaum's Artedi Genera Piscium, in which they appear, as those of Linné, Gronow, Bloch, and others, only as genera with names necessarily monomial.

If it is decided that both Klein and Walbaum are to be considered insufficient authority we shall take the next name applied to these Rays in order of time. This, applied in 1810 by Rafinesque, is in reality the same name, *Dasyatis* being merely an incorrect spelling.

This authority removes from the genus all of the Skates, *Rajæ*, and leaves but the first species of Klein's list, *Dasybatus pastinaca*. The objections to acceptance of the name from the earlier authorities can hardly be urged against receiving it from Rafinesque. In consideration of its original contents, his genus stands on the same footing as *Raja* of Linné. From the date 1810, if not before, the question in regard to the adoption of the name *Dasybatus* is simply one of priority.

Trygonobatus, 1816.

If we were to discard the previous name, *Trygonobatus* of Blainville, 1816, is the next in order of appearance. Aside from the later date, this

genus was not as well constituted as that of the preceding author. It included species belonging to different genera, to either of which the name, so far as its author was concerned, might equally well be applied. That Rafinesque had already founded a genus containing a portion of that of Blainville, however, would leave the name given by the latter applicable to species placed under it by him which did not belong to Rafinesque's genus, *Dasybatus*.

Trygon, 1817.

On page 136 of volume second of the first edition of the Règne Animal, Cuvier gives the name *Trygon* to the genus of the Pastinacas. From all that has been gathered on the subject, this, after the time of Linné, appears to be the first publication of the name in this connection. The author credits it to Adanson, but without indication of place: "LES PASTENAGUES (TRYGON Adans.)." I find no mention of the name by Adanson previous to that in the "Cours d'Histoire Naturelle," ii, 170, published in 1845. Probably Cuvier received it from the MSS.; subsequent writers have accepted it on his authority. His genus being identical with that of Rafinesque, it is evident that if the first publication of the name *Trygon* is that of 1817 it is only a synonym of *Dasybatus*. The absence of references, in the first edition, to Rafinesque's work indicates that it had not reached Cuvier at the time he was writing the Règne Animal. The edition of 1829 contains many references, but makes few changes on account of priority. Eichwald and later writers also use the name, crediting it to Adanson, but cite no place of publication. When references to Adanson's work have been given they cite the "Cours d'Hist. Nat.," the date for which is 1844–'45.

It remains to give attention to one other publication brought forward by authors to secure priority for the name *Trygon*. Geoffroy, in the "Description de l'Egypt," applies the name to a couple of species. If the date on the title page, 1809, was that of the entire work it would antedate that of Rafinesque. Though begun in that year, the book was under way nearly twenty years before reaching completion. The portion of the text containing the fishes of the Red Sea and the Mediterranean was written in 1825 or later. It contains citations from Risso, 1810, from Cuvier, 1817, and from the Annales des Sciences Naturelles, 1825. It was published in 1827. The portions of the work relating to the fishes appeared in the following order: in 1808, the plates of the Fishes of the Nile; in 1809, the text of the Fishes of the Nile, "comprenant le Polyptère, les Tétrodons et plusieurs Salmonidés"; in 1817, the balance of the plates of the fishes, those belonging to the Fishes of the Red Sea and the Mediterranean, among which were those of interest in this communication; and it was not until 1827 that these latter plates were followed by the text pertaining to them, that of the "Poissons de la mer Rouge et de la Méditerranée," in which are described two spe-

cies, under the name *Trygon*, that had been named and figured on plates published in 1817. In this publication there is nothing on which to base a claim for priority in favor of the name *Trygon*.

Unless there was a publication of the name *Trygon* between 1758 and 1810, not yet come to our notice, a due regard for the rule of priority compels its reduction to the rank of a synonym for *Dasybatus*.

At present the genus contains the species given below, nearly or quite all of which are valid.

DASYBATUS.

Raja tuberculata LaC., 1800, Hist. Poiss., ii, 106, pl. 4, f. 1.
Trygon reticulatus Gthr., 1880, Ann. Mag. N. H., vi., 8.
T. longa Garm., 1880, Bull. Mus. Comp. Zool., 170.
Raia centrura Mitch., 1815, Trans. Lit. & Phil. Soc., i, 479.
Trygon hastata DeK., 1842, N. Y. Fauna, Fishes, 375.
T. brevis Garm., 1880, Bull. M. C. Z., 171.
Raja sayi Les., 1817, Jour, Phil. Ac., i, 42.
Dasybatis dipterurus Jord., 1880, Pr. U. S. Mus., 31.
Trygon sabina, Les., 1824, Jour. Phil. Ac., iv, 109.
Raja uarnak Forsk., 1775, Descr. Anim., 18.
Trygon marginatus Blyth, 1860, Jour. As. Soc. Bengal, 38.
T. gerrardi Gray, 1851, Chondropt., 116.
T. punctata Gthr., 1870, Cat., viii, 474.
T. bleekeri Blyth, 1860, Jour. As. Soc. Bengal, 41.
T. walga M. & H., 1841, Plagiost., 159, pl. 50.
T. polylepis Blkr., 1852, Verh. Bat. Gen., xxiv, Plag., 73.
T. nuda, Gthr., 1870, Cat., viii, 476.
Raja gesneri Cuv., 1829, R. Anim., 400.
Trygon brucco Bonap., 1832–'41, Fauna Ital., Pesci.
T. violacea Bonap., l. c.
Raja pastinaca Linn., 1758, Systema, 232.
Trygon kuhlii M. & H., 1841, Plagiost., 1864, pl. 50.
T. margarita, Gthr., 1870, Cat., viii, 479.
T. rudis Gthr., 1870, *l. c.*, 479.
Hemitrygon ukpam Smith., 1859, Pr. R. Phys. Soc. Edinb., 64.
Trygon bennettii M. & H., 1841, Plagiost, 160, pl. 52.
Raja imbricata Bl., Schn., 1801, Syst. Ichth., 366.
Trygon zugei M. & H., 1841, Plagiost., 165, pl. 53.
T. brevicaudata Hutton, 1875, Ann. Mag. N. H. (4), xvi, 317.
T. liocephalus Klnzgr., 1871, Synops. Red Sea Fishes, 238.
T. lata Garm., 1880, Bull. M. C. Z., 170.
T. (*Himantura*) *oxyrhynchus* Sauvage, 1878, Bull. Soc. Philom., 94.
Dasybatus varidens Garm., 1885, Pr. U. S. Mus., 40.
Raja sephen Forsk., 1775, Descr. Anim., 17.

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Vol. VIII, No. 15. Washington, D. C. July 13, 1885.

THE INFLUENCE OF VARIATIONS OF TEMPERATURE UPON THE RATE AND THE WORK OF THE HEART OF THE SLIDER TERRAPIN. (PSEUDEMYS RUGOSA.)

By Dr. H. G. BEYER, U. S. N.,

Curator, section of Materia Medica, U. S. National Museum.

In the studies from the Biological Laboratory of the Johns Hopkins University, vol. iii, No. 2, I briefly described the results of some experiments made on the heart of the frog and terrapin with regard to the influence upon them of oxygenated and non-oxygenated blood, and of blood in various degrees of dilution. These results showed very clearly that the influence of oxygenated blood upon the heart with regard to both its rate and work done in a unit of time was a most decided one. The manner in which oxygenated and non-oxygenated blood was prepared was as follows: A quantity of defibrinated calf's blood was previously mixed with an equal volume of Ringer's saline, divided into two portions and each portion put into a bottle; one was allowed to stand quiet for a while, the other was shaken up for a few seconds every now and then until a perceptible difference in color was noticed. This was brought about in from five to ten minutes. Then the contents of these two bottles were turned into separate Mariotte's flasks, which were connected with inflow cannulas inserted into the great veins leading directly into the sinus, and when the time came for an observation the blood was allowed to run through the heart and its effect noted. It was noticed that the rate and the amount of work were always increased on supplying the heart with oxygenated blood; the former was increased from one to five beats per minute, the latter all the way from 30 to 175 per cent. A very slight agitation of the blood before returning it into the flask would increase the work done, even when the difference in color was not perceptible to the eye, a point of great importance in connection with experiments with drugs on the heart.

The results of the second group of experiments were, that the maximum amount of work was not done by the heart when supplied with simple undiluted defibrinated calf's blood. As a diluent the often-quoted Ringer's saline was used, the composition of which is as follows:

	c. c.
Normal salt solution (0.75 per cent.)	100
Calcium chlor. sol. (1.390)	5
Sod. bicarb. sol. (0.50 per cent.)	2.5
Sol. pot. chloride (1.0 per cent.)	0.75

With this saline mixture, the different nutrient liquids used in the experiments were prepared; the proportions varied all the way from one of blood to one of the saline, to one of blood and twenty of the saline. Most any of these solutions supplied to the heart in the usual manner from Mariotte's flasks caused the heart to yield more work than the simple defibrinated mammalian blood, but the mixture which proved the most favorable to the performance by the heart of normal and uniform work for any length of time was found to be the one in which equal volumes of blood and Ringer's saline had been used. Hence this proportion was used as a normal nutrient in all the subsequent experiments of this nature.

I propose here to supplement the above results by some recent experiments made with a view of ascertaining the influence of blood of different temperatures on the rate and work of the heart of the slider terrapin.

From the time when Calliburces (Claude Bernard, Système Nerveux, 392) first studied the influence of variations of temperatures on the frog's heart, we know that the rate increased in direct proportions to the temperature of the heart, whether the latter is isolated from the body of the animal or left *in situ*. Shelsky, extending these researches (Ueber die Veränderungen d. Erregbarkeit durch die Wärme, Heidelberg, 1860), working also with the frog's heart, ascertained that the automatic movements of the heart might be kept up within temperatures ranging all the way from 0° to 40° C., but that beyond these limits they were arrested, a recurrence of beats, however, taking place upon a return of the temperature to within this physiological limit.

Cyon (Ludwig's Arbeiten, 1866, p. 43), in a most carefully conducted series of experiments on the frog's heart, found that these limits were somewhat variable; that is to say, while some hearts stop beating at temperatures varying between 30° and 40° C., others continued to beat when cooled down to −4° C. From the more recent experiments on the isolated dog's heart by Prof. H. Newell Martin (Philosophical Transactions of the Royal Society, Part ii, 1883), we have furthermore positive proof of the fact that the rate of beat of the mammalian heart is directly dependent on the temperature of the fluid circulating through that organ, and that the increased pulse-rate in the condition known as *fever* can be sufficiently accounted for by the increased temperature which the blood assumes during its course through the inflamed organs.

While, then, the relation of the rate of beat of the heart of both warm and cold blooded animals to variations of temperature is pretty well understood and established, the same can hardly be said as being equally true with regard to the *work done*. In those pharmacological experiments on the hearts of cold-blooded animals, according to the method which will be found described in the July number of the American Journal of the Medical Sciences for 1885, the amount of work done by the heart forms one of the most important factors in the conclusions

to be derived. It is, therefore, of great importance to ascertain also the exact bearing of temperature upon the work done. So far as we are able to find this has never been done by *direct measurement*. Cyon (*loc. cit.*) ascertained it by calculation; direct measurement was impossible, according to the method which he used.

In the two subjoined experiments the temperature of the feeding fluids was ascertained by an extremely delicate thermometer, which was inserted into the common outlet tube, situated between the heart and the supplying Mariotte's flasks. The intention being to keep within the working limits of the temperature, the latter, in the two experiments, varied from 3° to 20° C. To produce a change in the temperature of the nutrient fluids, the flasks were either surrounded with ice or placed in a vessel containing hot water.

As a general rule, it may be stated that the amount of work done by the heart increases in direct proportion to the temperature of the circulating medium up to a certain limit, in the same way as does also the rate. But these two experiments show more than that. As will be seen, one was made in February and the other in the month of May. The highest temperature used in the former was 18° C., the rate being 46 per minute, the work done only 30 c. c. per minute. This was by no means the greatest amount of work done during the entire experiment; on the contrary, the maximum amount was obtained under a temperature of 12° C., the rate being 35 per minute. This shows the influence of the season upon the maximum limit of the work produced by temperature variations. This limit, in a winter animal, is accordingly at about 12° C. It is different with the rate, which, apparently, was still on the increase at 18° C., and since this was the highest temperature used in the experiment, its limit cannot be said to have been reached at all. The conclusion, therefore, to be derived from this experiment is that the maximum limit of the rate and the maximum limit of the work done by the heart of the terrapin do not necessarily correspond to the same degree of temperature of the circulating medium; the latter is reached much sooner than the former.

In the experiment made during the month of May the highest temperature used was 20° C., and here we see that neither of the two maximum limits have been reached under that temperature, but that, on the contrary, they still move together. The rate is about half of that in the February experiment under the same temperature, showing that the same temperatures affect the heart of cold-blooded animals differently in different seasons of the year, both as regards the rate as well as the work done. The maximum limit of the work produced lies much higher in spring animals than it does in winter animals. Thus, the influence of the season, by a comparison of these two experiments, is, I think, very well shown.

The practical deductions to be drawn from these experiments must, of course, be that a strict account of all variations of temperature of the

supplying liquids must be taken during the course of an experiment. This becomes more especially necessary when working in a room which is artificially heated and subject to sudden changes. A fact worth noting in this connection is the peculiar systolic standstill which was produced by the sudden change of the supplying fluids from a lower to a higher temperature. During this systolic arrest the ventricle became exceedingly small, looking pale and bloodless, while the auricles became very much enlarged and overdistended with blood, which they were unable to force into the contracted ventricle. This apparently shows that warmth is a most decided cardiac stimulant, especially so far as the ventricle is concerned. As, however, the temperature became equalized the ventricle began to become gradually relaxed and admitted the blood from the overdistended auricles, which, in spite of their having been much overdistended for sometimes one-half minute, showed not the slightest sign of weakening.

Experiment IV.

[February 7, 1885. Terrapin, 680 grms. Brain and spinal cord destroyed. Heart exposed. Canulas in left superior and inferior venæ cavæ and in right and left aortæ. Pig's blood and Ringer's saline used as a nutrient in the proportion of 1: 1. Venous pressure, 3.5 c. m. Arterial pressure. 15 c. m.]

Time p. m.	Temperature.	Rate per minute.	Work (in cubic centimeters) per minute.	Time p. m.	Temperature.	Rate per minute.	Work (in cubic centimeters) per minute.
h. m.	°*C.*			*h. m.*	°*C.*		
12 30*	......	......	....	2 35	5	5	14
1 00	7	12	23.5	40	4.5	5	14
05	7	12	23.5	43	55	5	21.5
10	6	9	22.5	45	11.5	14	29
15	6	9	22.5	47	12.5	15	32.5
20	5.5	8	20	50	12.5	15	32
25	5	8	17.2	55	7	7	20
30†	5	8	18	58	5	5	14
32	4.5	5	17.5	3 02	8	8	21
35‡	3.5	3	12.5	05	9	25	25
40	3	3	12.5	10	11	24	31
44	5	7	21	15	11	25	29
47	7.5	24	27	20	11.5	24	32
50	10	25	32	25	10.5	22	29
52	11	25	32	28	8	7	24
55	12	26	34	30	8	11	33
58	8	10	25	36	8	11	31.5
2 00§	5.5	7	19	40	14	32	41
05§	4.5	5	15	45	14	31	38
10§	4	5	16	48	13.5	32	33
15§	4	4	10.5	51	13	32	32
20	3.5	4	8	55	11	23	38
23	4	5	14	58	12	21	38
25	6	8	27.5	4 08	18	46	30
27	12	35	40	12	12	20	32
30	12.5	36	42	Experiment discontinued.			
33	7	8	21				

* Terrapin in box.

† Auricles contracting sluggishly.

‡ No auricular systole occurred.

§ Five long tonic ventricular contractions to one imperfect and incomplete auricular.

EXPERIMENT XXXI.

[May 4, 1885. Terrapin, 1,640 grms. Brain and spinal cord destroyed. Heart exposed. Inflow canulas in left superior and inferior venæ cavæ. Outflow canulas in right aorta and pulmon. artery. Calf's blood and Ringer's saline (1 : 1). Venous pressure, 5 c. m. Arterial pressure, 25 c. m.]

Time p. m.	Temperature.	Rate per minute.	Work (in cubic centimeters) per minute.	Time p. m.	Temperature.	Rate per minute.	Work (in cubic centimeters) per minute.
h. m.	°*C.*			*h. m.*	°*C.*		
2 00*	......	......	......	44	13	15	52
30	20	29	70	47	16	20	57
40	20	29	69	50	18	31	72
50	20	29	69	54	20	32	74
57	20	29	70	4 01	14	20	52
3 00	18	27	62	05	13	16	52
02	14	17	55	07	12	15	52
06	20	34	75	11	13	15	55
10	12	12	50	14	19	31	67
15	20	33	70	25	18	26	57
18	17	26	51	4 27	10.5	11	40
21	11	15	50	30	9	10	41
25	16	24	57	33	11	12	50
28	20	34	70	35	12	14	55
37	15.5	21	55	39	18	28	65
39	15	18	50	Experiment discontinued.			
42	13	16	50				

* Terrapin in box.

NOTE.—Every sudden change in the temperature of the circulating fluid admitted into the heart from low to high causes an immediate systolic ventricular standstill, lasting about 30 seconds, the auricles in the mean time becoming distended until from 3 to 4 times their normal size.

EXPLANATION OF PLATES.

Plate XVI is a graphic representation of Experiment XXXI.

Plate XV represents the different tracings attained under the various temperatures, from the same experiment, the long tonic ventricular systoles under the influence of the lower temperatures contrasting very remarkably with the quick energetic stroke of the ventricle under the influence of the higher temperatures.

DESCRIPTION OF A NEW SPECIES OF PEMPHERIS (PEMPHERIS POEYI) FROM CUBA.

By TARLETON H. BEAN,

Curator of the Department of Fishes, U. S. National Museum.

The United States National Museum possesses Professor Poey's type of *Pempheris mülleri*, and in the same bottle with it I have recently discovered a smaller specimen of a *Pempheris*, which is distinct from the type of Poey's description and appears to represent a species which is different from all of those hitherto described, so far as I am aware.

The type of the present description has received a new catalogue number, 37184. The length of the typical specimen to the base of the caudal is 46 millimeters. The species may be at once distinguished from *P. mülleri* by (1) the much larger scales on the sides, (2) its smaller eye, and (3) the much smaller number of rays in its anal fin.

The middle of the back is not so much elevated as in *P. mülleri.*

The length of the head is slightly more than one-third of the total without caudal. The eye is twice as long as the snout, and about two-fifths as long as the head. The maxilla is about one-half as long as the head and its posterior extremity is very much widened. The mandible is slightly longer than the maxilla, its length being nearly one-half the greatest height of the body. The width of the interorbital space equals one-half the length of the maxilla. The greatest height of the body equals two-fifths of the total length to caudal base. The least height of the tail equals the width of the interorbital area. The origin of the dorsal is slightly behind the vertical through the origin of the ventral, the distance from tip of snout to the origin of the dorsal being not much more than the length of the anal base. The longest dorsal ray slightly exceeds one-half the length of the head. The length of the dorsal base equals the length of the mandible. The origin of the dorsal fin is considerably in advance of the middle of the total length. The origin of the anal fin is directly under the end of the dorsal. The length of the anal base equals the greatest height of the body, and is not much in excess of the length of the head. The origin of the ventral is almost directly under that of the dorsal. The third ray of the ventral is as long as the eye. The pectoral is one-fourth as long as the total without caudal. The caudal fin is too imperfect to be described.

D. IV, 8; A. III, 24; V. I, 5; Sc. 2–56–12.

This species is dedicated to the distinguished Cuban naturalist, Prof. Félipe Poey.

NOTES ON EPINEPHELUS NIGRITUS, CAULOLATILUS MICROPS, AND CORYPHÆNA HIPPURUS.

By **TARLETON H. BEAN,**

Curator of the Department of Fishes, U. S. National Museum.

The United States Fish Commission steamer Albatross has recently returned from a cruise off the mouth of Chesapeake Bay, bringing to the Museum additional collections of desiderata, among them numerous species of fishes.

Two of the species taken on hand-lines and brought in fresh are referred to in the following paper. One of these is a smallish example of the black grouper, *Epinephelus nigritus*, which weighed 32 pounds after evisceration. Because of the comparative rarity of small specimens of this grouper, and also because of the doubt recently expressed by my friend, Professor Jordan, concerning the distinctness of *nigritus* from *morio*, the arrival of a fine young example from a region which is rather outside of its customary range is both interesting and opportune. After studying the Albatross specimen I am strengthened in my opinion that *nigritus* and *morio* are by no means identical, if, indeed, they may even be considered as closely related.

Caulolatilus microps has also been challenged as a synonym of *C. chrysops*, but I find in the present excellent examples additional confirmation of my belief in the specific difference between the two.

The great dolphin, *Coryphæna hippurus*, was sent from Pensacola, Fla., by Mr. Silas Stearns, to whom the Museum is indebted for many collections of great value.

1. Epinephelus nigritus. (Holbrook).

General color chocolate brown. Iris golden. Lower lip and anterior edge of cheek dark. Margin of soft dorsal and caudal with obscure dark band and bounded by rudiments of a very narrow light edge. Spinous dorsal brown, mottled with flesh-color and dusky. A very narrow white margin on the anterior half of the anal and a milky streak along the anal base and posterior margin of the anal. Outer margin of pectoral somewhat lighter than the rest of the fin. Membrane of ventral dark with lighter streaks.

A pair of strong canine-like teeth on each side of the front of the upper jaw and a single canine on each side in front of the mandible. The mandibulary teeth small and irregularly arranged anteriorly, and in two distinct series posteriorly. Maxillary teeth in a somewhat broad band, the teeth of the outer series very much enlarged, canine-like. Vomerine and palatine teeth small, in somewhat broad bands.

Posterior margin of preoperculum denticulated and with the points at the angle somewhat enlarged and irregular. Minute denticulations on the interoperculum and a short area of them on the suboperculum, also. Preorbital and lower limb of preoperculum smooth. Gill-rakers furnished with rather large teeth, usually in two series.

Measurements of Epinephelus nigritus (No. 37207.)

	Millimeters.		Millimeters.
Length to end of middle caudal rays	860	Anal:	
Body:		Distance from snout	605
Greatest width	132	Length of base	140
Height at ventrals	290	Length of first spine	25
Height at anal origin	221	Length of second spine	47
Least height of tail	100	Length of third spine	64
Head:		Length of first ray	107
Greatest length	338	Length of longest ray	110
Length of longest gill-raker	28	Length of last ray	69
Greatest width	126	Caudal:	
Width of interorbital area	65	Length of middle rays	156
Length of snout	86	Length of external rays	159
Length of operculum	120	Pectoral:	
Length of maxillary	136	Distance from snout	295
Length of mandible	179	Length	147
Distance from snout to orbit	100	Ventral:	
Diameter of eye	42	Distance from snout	335
Dorsal (spinous):		Length	145
Distance from snout	310	Branchiostegals	7
Length of base	250	Dorsal	xi, 14
Length of first spine	59	Anal	iii, 9
Length of second spine	125	Number of developed gill-rakers	2, 13
Length of last spine	66	Number of scales in lateral line	107
Soft:		Number of transverse rows above lateral line	24
Length of base	181		
Length of longest ray	92	Number of transverse rows below lateral line	37
Length of last ray	47		

2. **Caulolatilus microps**, Goode & Bean.

General color reddish brown. A brown colored spot at the base of most of the scales. A yellow streak under the eye extending forward about half way to the nostril. Spinous dorsal with a broad dark margin interspersed with some vague markings of brownish yellow. Entire margin of soft dorsal with a narrow band of yellow replaced by bluish gray along the extremity of the fin. General color of spinous and soft dorsal bluish gray, mottled with yellowish. Anal bluish white, with the exception of a broad band of yellow along the lower third of the fin, this bounded by a rather broad light-bluish margin. Pectoral mostly dark on the membrane, lighter along the rays. Caudal dark, with some streaks of yellow along the rays. Ventrals whitish. Under surface of head bluish white. Snout, upper lip, and top of head dusky. Iris iridescent with gold, green, and brown. A broad iridescent streak extending from and under the eye forward to the upper lip, this mottled with lighter and traversed by a yellow streak already mentioned. Some faint traces of yellow in the axilla of the pectoral. Some very vague indications of short dusky bands along the sides.

Measurements of Caulolatilus microps.

	Millimeters.		Millimeters.
Length to end of middle caudal rays	540	Anal:	
Body:		Distance from snout	295
Greatest width	72	Length of base	199
Height at ventrals	161	Length of first spine	6
Least height of tail	48	Length of second spine	16
Head:		Length of first ray	35
Greatest length	162	Length of longest ray	53
Length of longest gill-raker	8	Length of last ray	26
Greatest width	73	Caudal:	
Width of interorbital area	41	Length of middle rays	82
Length of snout	69	Length of external rays	112
Length of operculum	44	Pectoral:	
Length of maxillary	59	Distance from snout	161
Length of mandible	71	Length	117
Distance from snout to orbit	82	Ventral:	
Diameter of orbit	26	Distance from snout	179
Dorsal (spinous):		Length	88
Distance from snout	191	Branchiostegals	vi
Length of base	58	Dorsal	vii, 26
Length of first spine	15	Anal	ii, 23
Length of second spine	33	Pectoral	i, 16
Length of last spine	46	Ventral	i, 5
soft:		Number of scales in lateral line	117
Length of base	275	Number of transverse rows above lateral line	12
Length of first ray	46	Number of transverse rows below lateral line	42
Length of longest ray	56	Number of gill-rakers	8, 15
Length of last ray	25		

3. **Coryphæna hippurus**, Linné.

The example is a male with a very high and nearly vertical forehead. The colors have faded; at present the tail is mostly golden yellow; the sides to a considerable extent show the same color with an overlaying of bronze and a profuse sprinkling of black specks. The iris is yellow. The anal is dusky, intermingled with yellowish. The dorsal is very

dark, this color being intensified in a stripe about as long as the head without the snout, situated a little behind the middle of the fin.

The origin of the dorsal is slightly in advance of the vertical through the front of the orbit. The first twelve rays are simple, spine-like, increasing very rapidly in size so that the twelfth is very many times as long as the first. All the teeth, intermaxillary, mandibulary, vomerine, and palatine are in broad bands. The posterior nostril is the larger, its distance from the eye is two-thirds of the length of the eye, and its distance from the tip of the snout is one-third of the length of the mandible. The longest gill-raker is one-half as long as the eye.

Measurements of Coryphæna hippurus, L. (*No.* 37227).

[Locality: Pensacola, Fla.]

	Millimeters.
Length to end of middle caudal rays	1,005
Body:	
Greatest height	245
Height at ventrals	240
Least height of tail	50
Head:	
Greatest length	203
Length of longest gill-raker	16
Greatest width	90
Greatest height	250
Length of snout	61
Length of operculum	53
Length of upper jaw	95
Length of mandible	109
Distance from snout to orbit	68
Distance from eye to angle of fore-head	127
Diameter of eye	32
Dorsal (spinous):	
Distance from snout	154
Greatest height	177
soft:	
Length of longest ray	177

	Millimeters.
Soft Dorsal—Continued.	
Length of last ray	43
Anal:	
Distance from snout	500
Length of base	422
Length of longest ray	93
Length of last ray	43
Caudal:	
Length of middle rays	55
Length of external rays	280
Pectoral:	
Distance from snout	217
Length	176
Ventral:	
Distance from snout	250
Length	193
Branchiostegals	7
Dorsal	xii, 46
Anal	iii, 25
Pectoral	18
Ventral	i, 5
Number of gill-rakers	9

LIST OF THE BIRDS OF LABRADOR, INCLUDING UNGAVA, EAST MAIN, MOOSE, AND GULF DISTRICTS OF THE HUDSON BAY COMPANY, TOGETHER WITH THE ISLAND OF ANTICOSTI.

R:

By LUCIEN M. TURNER.

The scope of country intended to be embraced within the above heading is bounded on the north by Hudson Strait, extending from east to west; on the east by the Atlantic Ocean; on the south by the Gulf of Saint Lawrence to where the parallel of 50 degrees north latitude strikes the land, then west to the intersection of the 82d degree of east longitude. The western boundary is the 82d degree of west longitude north to Hudson Strait.

The period during which my own observations were made extends from June 15, 1882, to October 3, 1884.

The principal scene of my investigations was in the vicinity of Fort Chimo, situated about 27 miles up the Koksoak River, flowing into

Ungava Bay, which is an immense pocket toward the eastern portion of the south side of Hudson Strait. At this place I remained from August 6, 1882, to September 4, 1884.

The southern portions of the country are entirely subarctic in character, while the northern portions are strictly arctic.

The topography of the region is so diversified that even a scanty description is impracticable in this connection.

The climate is scarcely less diverse, the range of the thermometer at Fort Chimo being, for the period mentioned above, 86½ degrees for the maximum, and just 50 degrees below zero for the minimum, giving a range of 136.5 degrees for that period.

Winter begins (zero of temperature) about the 1st of November and continues to the last of April. Snow falls every month in the year, and the lowest temperature of each month in the year is never above the freezing point. The warmest night showed only 54 degrees. Snow remains from the last of September to the end of May; snow-shoes have been used as late as the 19th of May. Rain seldom falls before the 11th of May, and rarely after the middle of October.

The limit of trees ceases only 10 miles north of Fort Chimo. The principal trees are species of *Abies*, *Larix*, *Betula*, *Populus*, *Alnus*, *Salix*, and *Juniperus*. The more common flowering plants are *Anemone*, *Ranunculus*, *Draba*, *Viola*, *Arenaria*, *Stellaria*, *Lathyrus*, *Potentilla*, *Rubus*, *Ribes*, *Saxifraga*, *Epilobium*, *Heracleum*, *Taraxacum*, *Vaccinium*, *Kalmia*, *Rhododendron*, *Ledum*, *Pinguicula*, *Gentiana*, *Empetrum*, *Habenaria*, *Iris*, and *Smilacina*.

Of sedges and grasses, *Juncus*, *Scirpus*, *Eriophorum*, *Carex*, *Poa*, *Elymus*, and *Aira* are the more common.

Of animals, *Ursus maritimus*, *americanus*, and a species of barren-ground bear which I shall not attempt to designate, wolves, foxes, beavers, martens, wolverenes, minks, muskrats, few pekans, otters, porcupines, hares, rabbits, and many smaller kinds. Reindeer fairly swarm, in the northern portions. Moose are common in the southwestern parts.

The marine mammals are seals of several species, whales and porpoises of several species, and the walrus. Fishes abound on the coast and in the freshwater lakes and streams. The bird life is abundant in individuals if not in species. Some of the birds which most certainly occur within the territory, yet of which no satisfactory evidence of actual occurrence has been recorded, are with one or two exceptions, omitted for obvious reasons. *Tringa maritima*, for instance, certainly occurs somewhere along the coast, but has not been detected and recorded; the same with species of *Fulix*.

Reference is made to the following authorities, and extracts made without comment or responsibility for their assertions:

Audubon, J. J. Birds of America; seven volumes, published from 1840 to 1844.

Nuttall. Manual of Ornithology, 2d edition, 1840.

Verrill, A. E. Notes on the Natural History of Anticosti, summer of 1861. Proceedings of the Boston Society of Natural History, vol. ix, pp. 132 to 150, inclusive.

Coues, E. Notes on the Ornithology of Labrador, summer of 1860. Proceedings of the Academy of Natural Sciences of Philadelphia, August, 1861, pp. 215 to 257, inclusive.

Stearns, W. A. Notes on the Natural History of Labrador (with few additions on authority of Coues), 1880-'81-'82, pp. 111 to 138 inclusive, of the Proceedings of the United States National Museum, 1883.

Brewster, William. Notes on the Birds observed during a summer cruise in the Gulf of Saint Lawrence. Proceedings of the Boston Society of Natural History, vol. xxii, pp. 364 to 412, inclusive, October 3, 1883.

Richardson's Fauna Boreali-Americana, vol. 2.

Kumlein, L. Bulletin of the United States National Museum, No. 15. Contributions to the Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877-'78. Washington, 1879, pp. 69 to 105.

The names here adopted are, with certain changes and additions, made necessary by later investigation; taken from Ridgway's Nomenclature of North American Birds, Bulletin 21 of the United States National Museum, 1881.

One asterisk (*) denotes resident throughout the year.

Two asterisks (**) indicate breeding.

The numbers preceding the species refer to Ridgway's list, while those in brackets refer to Smithsonian Catalogue of 1859.

1. **Hylocichla mustelina** (GMEL.). *Wood Thrush.* [148.]

Stearns, p. 116, asserts that he heard this species in Southern Labrador.

2. **Hylocichla fuscescens** (STEPH.). *Wilson's Thrush.* [151.]

Audubon, vol. iii, p. 27, saw young July 20, 1833.

Brewster, p. 368, saw a pair July 24, 1881, on Anticosti.

3. **Hylocichla aliciæ** BAIRD. *Gray-cheeked Thrush.* [154.] **

Rare in Ungava. Common in southeastern and southern portions. Breeds wherever found in summer. Nest and eggs procured at Fort Chimo, June 28, 1884.

4*a*. **Hylocichla ustulata swainsoni** (CABAN.). *Olive-backed Thrush.* [153.]

Brewster, p. 369, obtained an adult female at Fox Bay, Anticosti, July 11, 1881.

Verrill reports it very common (p. 137) on Anticosti. Specimens were obtained June 13 and in July, 1860, at Rupert House, by Drexler.

5*b*. **Hylocichla unalascæ pallasi** (CABAN.). *Hermit Thrush.* [149.]

Brewster, p. 369, found it an abundant species at Anticosti and on the south shore of Labrador.

Verrill, p. 137, found it common at the same place.

7. **Merula migratoria** (LINN.). *American Robin.* [155.] **

Abundant throughout the country. Breeding plentifully at Fort Chimo, Ungava.

21. **Saxicola œnanthe** (LINN.). *Stone Chat.* [157.]

Coues, p. 218, obtained, August 25, 1860, at Henley Harbor, Labrador, a single individual of this bird.

30. **Regulus calendula** (Linn.). *Ruby-crowned Kinglet.* [161.] **

Common in southern portions. Audubon, vol. ii, p. 168, found them June 27, 1833, and saw the young of the year a month later.

Coues obtained a specimen August 6, at Rigolet, *vide* p. 219.

Stearns shot a single specimen at Old Fort Island, October 11, 1881, *vide* p. 116.

33. **Regulus satrapa** Licht. *Golden-crowned Kinglet.* [162.] **

Audubon, vol. ii, p. 165, found them feeding their young in August.

41. **Parus atricapillus** Linn. *Black-capped Chickadee.* [290.]

I am informed by credible persons, long resident in the country, that two species of Chickadees occur at Northwest River, at the head of Hamilton Inlet.

Verrill, p. 138, reports it very common on Anticosti.

45. **Parus hudsonicus** Forst. *Hudsonian Chickadee.* [296.] * **

Abundant everywhere in the wooded tracts. Young of the year were obtained July 19, 1882, at Davis Inlet, and in early August at Fort Chimo.

Audubon, vol. ii, p. 155, states that they found a nest in Labrador.

52. **Sitta canadensis** Linn. *Red-bellied Nuthatch.* [279.]

Audubon, vol. iv, p. 179, states that he saw one in Labrador which had probably been driven there by a storm.

Verrill, p. 138, reports it as common on Anticosti.

65. **Anorthura troglodytes hyemalis** (Vieill.). *Winter Wren.* [273.]

Audubon, vol. ii, p. 129, found this species in Southern Labrador, July 20, 1833.

Verrill, p. 138, states that he observed a small wren at Southwest Point, Anticosti, in July, which he thought was this species.

69. **Motacilla alba** Linn. *White Wagtail.* **(?)

Four individuals of this species were seen by Alex. Brown and James Lyall (of the Hudson Bay Company), August 29, 1883, at Hunting Bay, 4 miles south of Fort Chimo. These persons described the bird accurately, and declared they were the two parents and two young of the year. I must add that I place the fullest reliance in their assertion.

71. **Anthus pensilvanicus** (Lath.). *American Titlark.* [165.] **

Abundant throughout the territory. Nests and eggs obtained at Fort Chimo, where it breeds plentifully.

74. **Mniotilta varia** (Linn.). *Black-and-white Creeper.* [167*a*.]

A specimen was obtained at Moose Factory, May 13, 1860, and also on the 31st of that month, by C. Drexler.

Brewster, p. 369, obtained a specimen at Fox Bay, Anticosti, July 11, 1881.

87. **Helminthophila peregrina** (WILS.). *Tennessee Warbler.* [185.]

Obtained by Drexler, at Fort George, in June and July, 1860.

Brewster, p. 370, obtained a specimen near Fox Bay, Anticosti, July 11, 1881.

88. **Compsothlypis americana** (LINN.). *Blue Yellow-backed Warbler.* [168.]

Brewster, p. 370, saw a male at Fox Bay, Anticosti, July 11, 1881.

90. **Perissoglossa tigrina** (GMEL.). *Cape May Warbler.* [206.]

Specimen obtained by Drexler, May 28, 1860, at Moose Factory.

93. **Dendroica æstiva** (GMEL.). *Summer Yellow Bird.* [203.]

Specimen obtained by Drexler, July 12, 1860, at Fort George.

Brewster, p. 370, reports it abundant on Anticosti.

95. **Dendroica coronata** (LINN.). *Yellow-rump Warbler.* [194.] **

Audubon, vol. ii, p. 24, found them plentiful in Labrador, with young scarcely able to fly.

Drexler obtained specimens, July 21, 1860, at Moose Factory.

97. **Dendroica maculosa** (GMEL.). *Black-and-yellow Warbler.* [204.] **

Drexler obtained a specimen at Moose Factory, May 28, 1860.

Audubon, vol. ii, p. 66, reports it common, with eggs and nest in beginning of July, 1833.

Brewster, p. 371, found it abundant on Anticosti.

98. **Dendroica cærulea.** (WILS.). *Cerulean Warbler.* [201.]

Audubon, vol. ii, p. 63, states he found a dead one in Labrador.

100. **Dendroica castanea.** (WILS.). *Bay-breasted Warbler.* [197.]

Drexler obtained a specimen at Moose Factory, June 2, 1860.

Three individuals were seen at Black Island, Hamilton Inlet, by me July 9, 1882. Two were shot but lost in the thick undergrowth; one of the birds was actually in my hand, but escaped.

101. **Dendroica striata.** (FORST.). *Black-poll Warbler.* [202.] **

Abundant throughout the wooded portions of the region. Breeds plentifully at Fort Chimo, where seven nests and eggs were obtained in 1884 by me.

102. **Dendroica blackburniæ** (GM.). *Blackburnian Warbler.* [196.]

Audubon, vol. ii, p. 48, saw several in Labrador.

107. **Dendroica virens.** (GMEL.). *Black-throated Green Warbler.* [189.]

Brewster, p. 371, saw two or three on Anticosti.

113. **Dendroica palmarum hypochrysea** (RIDGW.). *Red-poll Warbler.* [208.] **

A specimen was obtained by Drexler at Moose Factory in July, 1860.

Audubon, vol. ii, p. 55, found them plentiful in Labrador. Young seen in August.

115. Seiurus auricapillus (LINN.). *Golden-crowned Thrush.* [186.] **

Stearns, p. 116, records this species as breeding in Southern Labrador.

Brewster, p. 371, saw a pair at Ellis Bay, Anticosti, July 21.

Verrill, p. 137, obtained specimens at Anticosti, July 15, 1861.

116. Seiurus nævius (BODD.). *Small-billed Water Thrush.* [187.] **

Several individuals, young of the year among them, were procured by me at Davis Inlet in August, 1884.

A specimen was procured at Moose Factory, May 26, 1860, by Drexler.

122. Geothlypis trichas (LINN.). *Maryland Yellow-throat.* [170.]

Common in southern portions of Labrador.

Stearns, p. 116, reports it from Natashquan.

Brewster, p. 371, found it at Fox Bay, Anticosti, July 11.

125. Myiodioctes pusillus (WILS.). *Black-capped Yellow Warbler.* [213.] **

Audubon, vol. ii, p. 21, records it as breeding in Labrador, and a nest obtained.

Brewster, p. 371, records it from Anticosti.

127. Myiodioctes canadensis (LINN.). *Canadian Fly-catching Warbler.* [214, 215.] **

Audubon, vol. ii, p. 15, reports it as breeding in Labrador.

128. Setophaga ruticilla (LINN.). *American Redstart.* [217.] **

Verrill, p. 137, records it as breeding on Anticosti, with young ones just able to fly, July 18, 1861.

A specimen was obtained by James McKenzie at Rupert House, September 3, 1860.

Brewster, p. 372, records it from Ellis and Fox Bays, Anticosti, and from Mingan, on the south shore of Labrador.

135. Vireosylvia olivacea (LINN.). *Red-eyed Vireo.* [240.]

Verrill, p. 138, reports it as common on Anticosti.

138. Vireosylvia philadelphica CASS. *Philadelphia Vireo.* [244.]

Individual obtained from Moose Factory, June 2, 1860, by Drexler.

143. Vireo noveboracensis (GMEL.). *White-eyed Vireo.* [248].

Audubon, vol. iv, p. 148, states that few were seen in Labrador.

148 Lanius borealis VIEILL. *Great Northern Shrike.* [236.] * **

Not common at Fort Chimo. Breeds there. Young, unable to fly more than a few rods, were taken by the hand at that place, June 30, 1884. Said to be common in the more southern portions, and there known as the "Silky Jay."

151. Ampelis cedrorum (VIEILL.). *Cedar Wax-wing.* [233.]

Specimen obtained August 26, 1860, by Drexler, at Moose Factory.

153. Petrochelidon lunifrons (SAY). *Cliff Swallow.* [226.] **

Verrill, p. 137, reports it breeding in large numbers, July 15, 1861, on Anticosti.

154. Chelidon erythrogastra (BODD.). *Barn Swallow.* [225.] **

Breeds at Northwest River, at the head of Hamilton Inlet.

155. Tachycineta bicolor (VIEILL.). *White-bellied Swallow.* [227.] **

Common at "Big" Island, in the Koksoak River, near Fort Chimo, where it breeds abundantly. Abundant throughout the northern portions.

Brewster, p. 372, saw two at Anticosti, June 9.

157. Clivicola riparia (LINN.). *Bank Swallow.* [229.] **

Audubon, vol. i, p. 189, states that it rarely begins to breed before June, and lays only once. Said to be plentiful on south shore of Labrador.

Verrill, p. 138, reports it plentiful on Anticosti.

166. Pinicola enucleator (LINN.). *Pine Grosbeak.* [304.] * **

Abundant in summer only at Fort Chimo. Breeds there; nest and eggs obtained.

Plentiful in southern districts among the timbered tracts. Resident south of the "Heighth of Land." This bird is known as the "Mope."

168. Carpodacus purpureus (GM.). *Purple Finch.* [305.]

Kumlein, p. 75, obtained one on shipboard off Resolution Island.

Drexler obtained it at Moose Factory, May 28, 1860.

Occurs plentifully in southern portions.

173. Loxia leucoptera GM. *White-winged Crossbill.* [319.] * **

Abundant at Fort Chimo in winter, rare during other winters. None observed in summer. Birds of the year are taken in early winter. Breeds in central portions and resident there.

178. Acanthis hornemanni (HOLLB.). *Mealy Redpoll.* [321.]

Very abundant in winter. Not occurring in summer from May 15 to September 1 of each year. Ft Chimo, on

178*a*. Acanthis hornemanni exilipes (COUES). *White-rumped Redpoll.* * **

Abundant and resident. Breeds plentifully at Fort Chimo, where nests and eggs were obtained.

179. Acanthis linaria (LINN.). *Common Redpoll.* [320.] * **

Abundant and resident. Breeds plentifully at Fort Chimo, where nests and eggs were obtained.

179*a*. **Acanthis linaria rostrata** (COUES). *Greater Redpoll.*

Rather common in winter. None to be seen from May 15 to September 1 of each year.

181. **Spinus tristis** (LINN.). *American Goldfinch.* [310.]

Kumlein, p. 76, caught an adult male on shipboard off Cape Mugford, August 22, 1877.

Occurs in southern portions of Labrador.

A bird called "Goldfinch" was described accurately, and asserted to occur occasionally at Fort Chimo, but I did not succeed in finding it.

185. **Spinus pinus** (WILS.). *Pine Goldfinch.* [317.]

Recorded by Audubon, vol. iii, p. 126, as common.

Brewster, p. 373, saw a flock, July 24, on Anticosti.

186. **Plectrophenax nivalis** (LINN.). *Snow Bunting.* [325.] * **

Abundant at Fort Chimo. Breeds on the islands in Ungava Bay and occasionally on the mainland. Resident in the southern portions of Labrador.

187. **Calcarius lapponicus** (LINN.). *Lapland Longspur.* [326.] **

Abundant at Fort Chimo. Breeds near the mouth of the Koksoak River and on the larger islands in Ungava Bay.

193*a*. **Passerculus sandwichensis savanna** (WILS.). *Savannah Sparrow.* [332.] **

Common throughout the region. Breeds at the mouth of the Koksoak River and at Davis Inlet.

206. **Zonotrichia leucophrys** (FORST.). *White-crowned Sparrow.* [345.] **

Very plentiful throughout the country. Breeds abundantly at Fort Chimo.

209. **Zonotrichia albicollis** (GM.). *White-throated Sparrow.* [349.] **

Reported by Stearns, p. 117, as common and breeding in Southern Labrador.

Audubon, vol. iii, p. 154, states that this species is common, and saw young late in July.

Drexler obtained this species at Moose Factory, May 31, 1860.

Verrill, p. 138, reports this species by far the most common singing bird at Anticosti.

210. **Spizella monticola** (GMEL.). *Tree Sparrow.* [357.] **

Common throughout the entire country. Breeds plentifully at Fort Chimo, where eggs and nests were taken.

217. **Junco hyemalis** (LINN.). *Black Snowbird.* [354.] **

Not observed in the Ungava district. Common in the eastern and southern portions of Labrador. Breeds at Davis Inlet and Rigolet. Known as the "Stone Chat" on the east coast.

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234. Melospiza lincolni (AUD.). *Lincoln's Finch.* [368.] **

Rare at Fort Chimo; a male obtained June 10, 1883. Common in southern portions.

Audubon, vol. iii, p. 117, found young July 4, 1833.

Drexler procured specimens at Moose Factory, May 23, 1860.

233. Melospiza palustris (WILS.). *Swamp Sparrow.* [369.]

Audubon, vol. iii, p. 111, states it to be abundant in Labrador.

Brewster, p. 375, found it plentiful on Anticosti.

235. Passerella iliaca (MERREM). *Fox-colored Sparrow.* [374.] **

Common in southern portions. Young obtained at Rigolet late in June and early July, 1882.

237. Pipilo erythrophthalmus (LINN.). *Chewink; Towhee.* [391.]

Audubon, vol. iii, p. 168, states that it occurs northward to Labrador.

273. Scolecophagus ferrugineus (GM.). *Rusty Blackbird.* [417.] **

Common. Breeds at Fort Chimo, where young just from the nest were obtained, July 10, 1884.

280. Corvus corax carnivorus (BARTR.). *American Raven.* [423, 424.] * **

Abundant throughout the region. Breeds at Fort Chimo; nearly fledged young seen in nest May 18.

282. Corvus frugivorus BARTR. *Common Crow.* [426.]

Rare and only found in southern portions.

Audubon, vol. iv, p. 89, states few were to be seen in Labrador.

Coues, p. 226, saw one flying.

Stearns, p. 117, reports it from Eskimo River.

Verrill, p. 138, records it as very common on Anticosti. Not known to breed in Labrador.

297. Perisoreus canadensis (LINN.). *Canada Jay.* [443] * **

Plentiful in interior of southern and western portions. Breeds and resident wherever found.

——. Perisoreus canadensis nigricapillus (RIDGW.). * **

Coastwise and interior especially abundant. Resident and breeds at Fort Chimo.

300. Otocoris alpestris (FORST.). *Shore Lark.* [302.] **

Common. Breeds at the mouth of the Koksoak River and at Rigolet.

304. Tyrannus tyrannus (LINN.). *Kingbird; Bee Martin.* [124.] **

Audubon, vol. v, p. 207, found it breeding in Labrador.

315. Sayornis phœbe (LATH.). *Phœbe Bird; Pewee.* [135.] **

Audubon, vol. i, p. 220, states that he found it breeding in Labrador.

318. Contopus borealis (SWAINS.). *Olive-sided Flycatcher.* [137.]

Audubon, vol. i, p. 215, records it from the coast of Labrador.

320. Contopus virens (LINN.). *Wood Pewee.* [139.]

Audubon, vol. i, p. 233, records it from Labrador.

322. Empidonax flaviventris BAIRD. *Yellow-bellied Flycatcher.* [144.]

Brewster, p. 380, reports it common at Ellis Bay, Anticosti.

326. Empidonax minimus BAIRD. *Least Flycatcher.* [142.] **

Audubon, vol. i, p. 237, found it nesting in Labrador.

Obtained by Drexler at Moose Factory, May 30, 1860.

335. Trochilus colubris LINN. *Ruby-throated Hummingbird.* [101.]

A single individual, male, was seen within 4 feet of me July 17, 1882, on the hill-top (825 feet elevation) back of the station at Davis Inlet.

Audubon, vol. iv, p. 195, states that few were seen in Labrador.

357. Chordeiles virginianus (GMEL.). *Nighthawk.* [114.]

Stearns, p. 117, records it from Natashquan.

Obtained by Drexler in August, 1860, at Moose Factory.

360. Dryobates villosus (LINN.). *Hairy Woodpecker.* [74.] * **

Resident in southern portions of Labrador; probably does not occur north of the "Heighth of Land."

361. Dryobates pubescens (LINN.). *Downy Woodpecker.* [76.] * **

Common and resident in southern portions; probably does not range north of 56°.

Audubon, vol. iv, p. 249, reports it from Texas to Labrador.

Brewster, p. 381, found it breeding at Fox Bay, Anticosti, July 11.

367. Picoides arcticus (SWAINS.). *Black-backed Three-toed Woodpecker.* [82.] * **

Common and resident throughout the wooded portions.

368. Picoides americanus BREHM. *Banded-backed Three-toed Woodpecker.* [83.] * ** Common and resident throughout the wooded portions.

378. Colaptes auratus (LINN.). *Yellow-shafted Flicker.* [97.] **

An accidental straggler was procured from the mainland near Akpatok Island, Hudson Strait, in October, 1882. Reported to be a common summer visitor to Northwest River.

382. Ceryle alcyon (LINN.). *Belted Kingfisher.* [117.] **

A summer visitor to Northwest River, where it breeds.

Drexler obtained a specimen, May 26, 1860, at Moose Factory.

Audubon, vol. iv, p. 208, records that he has met with it from Texas to Labrador.

387. Coccyzus americanus (LINN.). *Yellow-billed Cuckoo.* [69.]

Audubon, vol. iv, p. 296, states that even in Labrador he has met with a few of them.

388. Coccyzus erythrophthalmus (WILS.). *Black-billed Cuckoo.* [70.]

Audubon, vol. iv, p. 301, states that they saw few in clumps of low trees a few miles from the shore of the gulf. (The text evidently refers to Labrador.)

396. Asio accipitrinus (PALL.). *Short-eared Owl.* [52.] * (?) **

Common in summer only at Fort Chimo. Specimens obtained there and at Davis Inlet. A very light-colored individual was seen, July 18, 1882, at Davis Inlet. Downy young individual was obtained at Fort Chimo. Plentiful on the east shore of Hudson Bay. Not known to winter in the Ungava district.

399. Ulula cinerea (GMEL.). *Great Gray Owl.* [53.]

Specimen (No. 32306 ♂) in the Smithsonian Institution collection was obtained by James McKenzie at Moose Factory. No record from other parts of the country.

401. Nyctala acadica (GMEL.). *Saw-whet Owl.* [56, 57.]

Specimen (No. 32301) in Smithsonian Institution was obtained at Moose Factory by James McKenzie.

405. Bubo virginianus saturatus RIDGW. *Dusky Horned Owl.* * **

Not rare at Fort Chimo. Resident. Downy young obtained June 20, 1884.

406. Nyctea nyctea (LINN.). *Snowy Owl.* [61.] * **

Common throughout the country. Breeds at Fort Chimo.

407. Surnia ulula caparoch (MÜLL.). *American Hawk Owl.* [62.] * **

Rare at Fort Chimo. Eggs otained June 8, 1884, and downy young nearly ready to leave the nest were taken June 20.

412. Hierofalco islandus (BRÜNN). *White Gyrfalcon.* [11.] * **

Common at Fort Chimo and east coast of Labrador. Resident in northern portions, and breeds at Fort Chimo.

412*a*. Hierofalco rusticolus (LINN.). *Iceland Gyrfalcon.* [12.] * (?) **

Winter specimens only obtained at Fort Chimo. Not known to breed in the Ungava district.

412*c*. Hierofalco rusticolus obsoletus (GM.). *Labrador Gyrfalcon.* * **

Abundant at Fort Chimo. Eggs obtained May 24. Young and adult specimens of this bird procured. Very rare in winter at Fort Chimo.

414. Falco peregrinus anatum (BP.). *American Peregrine Falcon; Duck Hawk* [5, 6.] **

Abundant at Fort Chimo. Eggs, downy young, and adults taken there. Does not pass the winter in the Ungava district.

417. Æsalon columbarius (LINN.). *Pigeon Hawk.* [7.] **

Audubon, vol. i, p. 89, states that eggs and nest were found about June 1.

Coues, p. 216, met with it on two occasions; one at Groswater Bay on August 5, and on the 25th of August at Henley Harbor.

420. **Tinnunculus sparverius** (LINN.). *Sparrow Hawk.* [13.]

Coues, p. 216, saw a single individual in Labrador.

425. **Pandion haliaetus carolinensis** (GM.). *American Osprey; Fish Hawk.* [44.] **

Mr. John Ford assured me that the Fish Hawk breeds, four or five pairs of them, about 4 miles above the station of the Hudson Bay Company on Northwest River.

Nuttall, page 81, reports it from Labrador.

Brewster, p. 382, records that few were seen at Anticosti.

430. **Circus hudsonius** (LINN.). *Marsh Hawk.* [38.]

Audubon, vol. i, p. 105, saw it in Labrador.

432. **Accipiter fuscus** (GMEL.). *Sharp-shinned Hawk.* [17.]

Richardson, vol. ii, p. 44, states that one was killed near Moose Factory and deposited by the Hudson Bay Company in the museum of London.

Verrill, p. 137, reports having seen this species near Salmon River, July 3, 1861.

433. **Astur atricapillus** (WILS.). *American Goshawk.* [14.] * **

Resident in Ungava district. Winter specimen obtained in early December, 1882. Breeds at the "Chapel" near Fort Chimo. Specimen obtained from Rigolet. Known as "Partridge Hawk."

443. **Buteo pennsylvanicus** (WILS.). *Broad-winged Hawk.* [27.]

Specimen (No. 33209 ♂) in Smithsonian Institution collected by James McKenzie in 1862 at Moose Factory.

447. **Archibuteo lagopus sancti-johannis** (GMEL.). *American Rough-legged Hawk.* [30, 31.] **

Both light and dark phases, with their eggs, young, and adults, collected at Fort Chimo. Apparently more abundant on eastern and northern shores than on the southern portions of Labrador. Downy young were also obtained, of the black phase, July 17, 1882, at Davis Inlet. Termed "Squalling Hawk" by the planters.

449. **Aquila chrysaetus canadensis** (LINN.). *Golden Eagle.* [39.] **

Specimens procured in Ungava district. Breeds in the northeastern portions among the hills. A pair also breed at the "Forks" in the Ungava district. The Eagles are termed "Grepe" by the planters, and is a word derived from some of the earlier Scandinavian settlers on the coast who apply the term *Grepe* to a Vulture.

451. **Haliæetus leucocephalus** (LINN.). *Bald Eagle; Gray Eagle.* [41, 43.] **

Nuttall, p. 75, states it as breeding and rearing their young in all the intermediate space from Nova Scotia or Labrador to the shores of the Gulf of Mexico.

+459. **Ectopistes migratoria** (LINN.). *Passenger Pigeon.* [448.]

Specimen obtained, August 16, 1860, by C. Drexler, at Moose Factory.

Verrill, p. 138, saw a single individual at Heath Point, Anticosti, and was informed that they are very rare there.

472 **Dendragapus canadensis** (LINN.). *Canada Grouse; Spruce Partridge.* [460.]* **

Abundant throughout the wooded tracts. Resident. Eggs, downy young, and adults procured at Fort Chimo.

+473. **Bonasa umbellus** (LINN.). *Ruffed Grouse.* [465.] * **

Occurs rarely at the head of Hamilton Inlet, but only on the south side; rather common at Paradise River, flowing into Sandwich Bay, and abundantly in the valleys to the southward where birch grows plentifully. These birds are known as "French Hens."

Audubon, vol. iv., p. 80, reports it as common from Maryland to Labrador.

474. **Lagopus alba** (GM.). *Willow Ptarmigan.* [467, 470.] * **

Exceedingly abundant throughout the country. Breeds by thousands at Fort Chimo, where eggs, adults, and young in all stages were procured.

+475. **Lagopus rupestris** (GM.). *Rock Ptarmigan.* [468.] * **

Plentiful everywhere on the treeless areas. Eggs, young in all stages, and adults were procured from various places.

+487. **Ardea herodias** LINN. *Great Blue Heron.* [487.]

An individual was seen by Mr. John Saunders (of the Hudson Bay Company) to fly from the creek which is the outlet of Whitefish Lake, near Fort Chimo, in the summer of 1880. A specimen was obtained at Moose Factory by James McKenzie, August 29, 1860.

Verrill, p. 138, states that a large Heron, which appeared to be of this species, was seen at Ellis Bay, Anticosti.

497. **Botaurus lentiginosus** (MONTAG.). *American Bittern.* [492.] **

According to Coues, p. 227, a wing of a Bittern was seen in the possession of a native at Rigolet (?).

Drexler found it breeding at Moose Factory, and obtained specimens August 29, 186–.

Verrill, p. 138, records it as common at Anticosti. A young one, just able to fly, was caught August 4.

507. **Hæmatopus palliatus** TEMM. *American Oystercatcher.* [512.] **

Audubon, vol. v, p. 237, found several breeding in Labrador.

509. **Arenaria interpres** (LINN.). *Turnstone.* [515.] **(?)

Occasional at Ungava Bay. A young bird of the year was obtained there in the middle of September, 1882, and an adult at Davis Inlet. Not rare on the east coast.

513. Squatarola squatarola (LINN.). *Black-bellied Plover.* [510.]

Sterns, p. 118, reports it plentiful in South Labrador. Not observed in the Ungava district. Not breeding.

515. Charadrius dominicus MÜLL. *American Golden Plover.* [503.]

Occurs, in fall only, at the mouth of the Koksoak. Common in the southern and western portions near the coast. Not known to breed there.

517. Ægialitis semipalmata BONAP. *Semipalmated Plover.* [507.] **

Occurs abundantly throughout the coast region. Eggs, downy young, and adults obtained from Ungava, and downy young with their parents obtained from Davis Inlet. Known as "Beach Bird" in Labrador.

525. Philohela minor (GMEL.). *American Woodcock.* [522.]

Several persons assured me that they had killed Woodcocks on the eastern portions of the Labrador shore.

526*a*. Gallinago wilsoni (TEMM.). *Wilson's Snipe.* [523.] **

I heard and saw a male making the peculiar noise with its wings, in early June, over a swamp to the north of Davidson's Lake, a few miles from Fort Chimo. Specimens were procured, June 15, 1860, by Drexler, at Rupert House.

Coues, p. 229, met with a single specimen.

527. Macrorhamphus griseus (GMEL.). *Red-breasted Snipe; Gray Snipe.* [524.]

Rare at Fort Chimo. Common in southern and western portions. Specimens obtained at Fort Chimo and Davis Inlet.

529. Tringa canutus LINN. *Knot; Robin Snipe.* [526.]

Audubon, vol. v, p. 256, states that it ranges along the coast from Texas to Labrador, but does not record having met with it in the latter country.

Coues, p. 229, obtained at Henley Harbor a few specimens in immature plumage.

530. Arquatella maritima (BRÜNN.). *Purple Sandpiper.* [528.]

Although I can find no record of the occurrence of this species in Labrador, yet it abounds on the Atlantic coast to the north and south of Labrador in spring and fall.

534. Actodromas maculata (VIEILL.). *Pectoral Sandpiper.* [531.] **

Common almost everywhere on the coast. Specimens procured by Coues, p. 230; Stearns, p. 119, and by myself.

536. Actodromas fuscicollis (VIEILL.). *Bonaparte's Sandpiper.* [533.]

Excessively abundant at the mouth of the Koksoak River in July, August, and September; also on the eastern shore of Labrador. Not known to breed in the country.

538. Actodromas minutilla (VIEILL.). *Least Sandpiper.* [532.] **

Not common at Ungava. I have reason to believe that occasional pairs breed at the mouth of the Koksoak River.

Audubon, vol. v, p. 282, states that he found nest and eggs, July 20, 1883, in Labrador.

Coues, p. 232, observed it to be plentiful in Labrador.

Brewster, p. 386, observed a few daily on the beach at Anticosti.

Stearns, p. 119, records it common in spring and fall, and breeds in summer.

541. Ereunetes pusillus (LINN.). *Semipalmated Sandpiper.* [535.] **

Occurs sparingly at the mouth of the Koksoak River, and from its actions indicated breeding.

Audubon, vol. v, p. 278, states he found them dispersed in pairs and having nests early in June in Labrador.

Stearns, p. 119, reports this species as common in spring and fall.

542. Calidris arenaria (LINN.). *Sanderling.* [534.]

Three individuals were seen at the mouth of the Koksoak River associated with *Actodromas bonapartei.* Two of these were obtained.

Audubon, vol. v, p. 288, states he saw young in Labrador early in August, 1833, moving southward.

545. Limosa hæmastica (LINN.). *Hudsonian Godwit.* [548.]

Rare. Drexler obtained a specimen near Rupert House, July 30, 1860.

Stearns, p. 119, obtained a single individual at Old Fort Island.

548. Totanus melanoleucus (GMEL.). *Greater Yellow-legs; Tell-tale.* [539.]**

Not common in Ungava district. Specimens obtained at the mouth of the Koksoak River and only in the fall.

Audubon, vol. v, p. 319, states he found this species breeding in June in Labrador.

549. Totanus flavipes (GMEL.). *Yellow-legs.* [540.]

A single individual was seen October 8 about 50 miles above Fort Chimo, on the Koksoak River, flying from a bar.

Audubon, vol. v, p. 313, states he found few of these birds in Labrador.

+ **550. Rhyacophilus solitarius** (WILS.). *Solitary Sandpiper.* [541.]** (?)

A single individual was obtained near Fort Chimo in July. Its actions indicated breeding.

556. Tryngites rufescens (VIEILL.). *Buff-breasted Sandpiper.* [516.]

Coues, p. 235, obtained a single individual August 20, 1860.

+ **557. Actitis macularia** (LINN.). *Spotted Sandpiper.* [543.] **

Common at Fort Chimo, where downy young and adults were procured.

Audubon, vol. v, p. 303, states he found it breeding in Labrador, July 17, 1833, and obtained fully-fledged young July 29.

558. Numenius longirostris WILS. *Long-billed Curlew.* [549.]

Most diligent inquiry failed to satisfy me that this species occurs on the north, east, or southern portions of Labrador. Coues apparently satisfied himself, from inquiry, that the bird does occur there, *vide* p. 235.

559. Numenius hudsonicus LATH. *Hudsonian Curlew.* [550.]

I saw three individuals of this species in September, 1882, at the mouth of the Koksoak.

Coues, p. 235, procured a few individuals.

560. Numenius borealis (FORST.) LATH. *Eskimo Curlew.* [551.]

Several large flocks were seen September 4, 1884, flying over the mouth of the Koksoak River. Plentiful in the fall in the southern portions and as far north as Davis Inlet; they do not halt above this latter place while on their way southward.

563. Crymophilus fulicarius (LINN.). *Red Phalarope.* [521.] **

Abundant on the Labrador coast north of Davis Inlet. Common in Hudson Strait. Rare in Ungava Bay, where a specimen was obtained. Breeds sparingly in Hudson Strait.

564. Phalaropus lobatus (LINN.). *Northern Phalarope.* [520.] **

Breeds on the islets in Ungava Bay. Common on northern portions of the Labrador coast.

572. Rallus virginianus LINN. *Virginian Rail.* [554.]

A single specimen was taken in Hamilton Inlet a few years ago and submitted to M. Fortesque, esq. (of the Hudson Bay Company), who identified it beyond question.

574. Porzana carolina (LINN.). *Sora Rail.* [555.]

Obtained by Drexler, August 26, 1860, at Moose Factory.

580. Fulica americana GMEL. *American Coot.* [559.]

A specimen was shot on a lake near Nain several years ago. Several persons who saw the stuffed bird described this species beyond possibility of doubt.

588. Olor columbianus (ORD.). *Whistling Swan.* [561 *a.*]

An occasional straggler over the southern portions only of Labrador. The Eskimo of the western side and northern end of the region apply the name Kóogzhook to this bird, and is exactly the same name as is given to it by the Eskimo of Norton Sound, Alaska.

591. Chen hyperboreus nivalis (FORST). *Greater Snow Goose.* [563.]

Occasionally a straggler is seen in the western portions and along the western end of Hudson Strait. Eskimo from the eastern shore of Hudson Bay reported it to be very plentiful during the migration.

Those people apply the term Kangōk to this species, and what is rare among the names of birds is, that the same term is applied to this species by the Eskimo of Norton Sound, Alaska.

594. Branta canadensis (LINN.). *Canada Goose.* [567.] **

Common throughout the territory. Breeds along Hudson Strait near the mouth of George's River, where eggs, young and, adults were procured.

Breeds plentifully on Anticosti, according to Verrill, p. 139.

595. Branta bernicla (LINN.). *Brant.* [570.]

Seen in spring only at Fort Chimo. Not known to breed in the region.

Audubon, vol. vi, p. 205, states that it breeds from Labrador northward.

+ **601. Anas boschas** (LINN.). *Mallard.* [576.]

Rare at Fort Chimo. Common on eastern and more plentiful on southeast coast. Specimens obtained from Davis Inlet and at the mouth of the Koksoak River, known in Labrador as Mallard and Green Head.

+ **602. Anas obscura** GMEL. *Black Mallard.* [577.] **

Not common in Hudson Strait. Doubtless breeds there, as a female obtained in July had the abdomen bare and no quills in the wings.

Audubon, vol. iv, p. 246, found eggs and young July 5, 1833.

Verrill, p. 139, states that it breeds abundantly on Anticosti.

604. Chaulelasmus streperus (LINN.). *Gadwall.* [584.] **

Not observed in Hudson Strait.

Verrill, p. 139, states that few specimens were seen on Anticosti, and a half-grown young one was caught near the middle of July.

605. Dafila acuta (LINN.). *Pintail.* [578.]

A single (young of the year) female was taken at the mouth of the Koksoak River. An adult was procured at Davis Inlet. It is very doubtful that this species breeds in the Ungava district.

607. Mareca americana (GMEL.). *Baldpate.* [585.]

Mr. John Ford assures me that the Widgeon is common in Hamilton Inlet and on the southeast shore of Labrador.

609. Querquedula discors (LINN.). *Blue-winged Teal.* [581.]

Brewster, p. 389, records that fishermen report its occurrence at Anticosti.

[611.] Nettion crecca (LINN.). *English Teal.* [580.]

Coues, p. 238, obtained a male in Labrador, July 23, 1860.

+ **612. Nettion carolinensis** (GMEL.). *Green-winged Teal.* [579.]

Fully-fledged young females were obtained at Fort Chimo late in July.

Coues, p. 238, saw it in a collection at Rigolet.

613. Aix sponsa (LINN.). *Wood Duck; Summer Duck.* [587.]

Stearns, p. 120, reports it not rare in the interior of Labrador.

618. Æthyia americana (EYT.). *Redhead.* [591.]

Stearns, p. 120, reports it as common, and saw an individual, September 20, in Baie des Roches.

619. Clangula islandica (GMEL.). *Barrow's Golden-eye.* [594.]

Obtained specimens from Davis Inlet. Plentiful in the fall on the Labrador coast.

620. Clangula clangula americana (BP.). *American Golden-eye.* [593.]

Specimens were obtained from Ungava Bay, where it is abundant in fall, as it is also on the Labrador coast.

622. Histrionicus histrionicus (LINN.). *Harlequin Duck.* [596.]

Abundant in Hudson Strait. Specimens from Ungava Bay, where this duck certainly breeds. Plentiful on the eastern coast of Labrador.

623. Harelda hyemalis (LINN.). *Long-tailed Duck; Old Squaw.* [597.] **

Abundant in the proper season along the entire coast. Eggs, downy young, and adults were procured at Fort Chimo.

624. Camptolaimus labradorius (GMEL.). *Labrador Duck.* [600.]

Formerly abundant. Now supposed to be extinct.

627. Somateria mollissima (LINN.). *Common Eider.* *(?) **

Abundant in Hudson Strait. Eggs, young of the year, and adults procured in Ungava Bay. Plentiful on eastern and southern coasts.

627*a*. Somateria dresseri SHARPE. *American Eider.* [606.] *(?) **

Common on south shore of Labrador.

629. Somateria spectabilis (LINN.). *King Eider.* [608.] *(?) **

Abundant on Atlantic coast of Labrador, where it is reported to breed. Nest and eggs were found by N. A. Comeau near Mingan (*vide* Canadian Naturalist and Sportsman, vol. i, No. 7, p. 51, July 15, 1881). Not known to enter Hudson Strait.

630. Oidemia americana SW. & RICH. *American Scoter.* [604.]

Obtained at the mouth of the Koksoak River. Abundant in Hudson Strait and eastern shore of Labrador, where it is reported to breed sparingly.

632. Melanetta velvetina (CASS.). *American Velvet Scoter.* [601.] **

Obtained from the eastern shore of Labrador. Common along all the coast.

The *Œ. fusca* of Audubon, vol. vi, p. 333, doubtless refers to this species, and he reports it as common. Nesting and young able to swim from June 1 to July 28.

633. Pelionetta perspicillata (LINN.). *Surf Duck.* [602.] **

Rare in Hudson Strait. Abundant on the eastern coast of Labrador, where it breeds sparingly.

636. Merganser americanus (CASS.). *American Sheldrake.* [611.]

Stearns, p. 121, reports he has seen one individual of this species near Fort Island. This is probably the "Pie bird" that I heard of on the Labrador coast.

637. Merganser serrator (LINN.). *Red-breasted Sheldrake.* [612.] **

Abundant throughout the country. Breeds. Downy young, unfledged young, and adults were procured at Ungava and Davis Inlet. Known as "Shell-bird" on the Labrador coast.

638. Lophodytes cucullatus (LINN.). *Hooded Sheldrake.* [613.]

Stearns, p. 121, records it as rather rare, but occasional in Southern Labrador.

642. Phalacrocorax carbo (LINN.). *Common Cormorant.* [630.] **

Not observed in Hudson Strait. Plentiful, and breeding along the eastern and southern coasts.

643. Phalacrocorax dilophus (SW. & RICH.). *Double-crested Cormorant.* [623.] **

Plentiful, and breeding along the eastern and southern coasts. Not observed in Hudson Strait.

650. Sula bassana (LINN.). *Gannet.* [617.] **

Abundant and breeding on southeast and southern shores of Labrador.

657. Gavia alba (GUNN.). *Ivory Gull.* [676, 677.]

Audubon, vol. vii, p. 150, records it from south shore of Labrador. Not known to enter Hudson Strait.

658. Rissa tridactyla (LINN.). *Kittiwake Gull.* [672.] **

Breeds plentifully on the northern portions of the Atlantic coast of Labrador.

Brewster, p. 398, found young on Anticosti. Occurs but rarely in Hudson Strait. One individual was seen over 100 miles up the Koksoak River, October 13, 1883.

Verrill, p. 141, reports them breeding in immense numbers on the eastern and northern shores of Anticosti.

660. Larus glaucus BRÜNN. *Glaucous Gull; Burgomaster.* [656.] **

Not rare in Hudson Strait. Not known to breed there. Breeds plentifully on the eastern and southern coasts of Labrador.

661. Larus leucopterus FABER. *White-winged Gull.* [658.]

Audubon, vol. vii, p. 159, states that few were seen in Labrador.

663. Larus marinus LINN. *Great Black-backed Gull.* [660.] **

Not observed in Hudson Strait.

Audubon, vol. vii, p. 174, reports it common and breeding on Labrador coast.

Coues, p. 244, obtained young, a few days old, at Sloop Harbor, June 4, 1860.

Brewster, p. 395, found young of few days old on Anticosti.

Known as the "Saddler" or "Saddle-back" on the coast.

666*a*. **Larus argentatus smithsonianus** COUES. *American Herring Gull.* [661.] **

Excessively abundant in Hudson Strait, where eggs, young, and adults were obtained. Common on the Atlantic coast of Labrador.

669. **Larus delawarensis** ORD. *Ring-billed Gull.* [664.] ** (?)

Coues, p. 246, obtained three young of the year at Henley Harbor, August 21, 1860.

675. **Larus philadelphia** (ORD). *Bonaparte's Gull.* [670.]

Coues, p. 247, saw immature birds.

Sterns, p. 122, reports it to be abundant in fall on the southern coast. Not known to breed in any part of Labrador.

677. **Xema sabinei** (J. SABINE). *Sabine's Gull.* [680.]

A single male was obtained in the middle of July, 1884, near the mouth of George's River, flowing into the eastern side of Ungava Bay.

680. **Sterna caspia** PALL. *Caspian Tern.* [682.]

An individual was obtained by James McKenzie at Moose Factory.

686. **Sterna hirundo** LINN. *Common Tern.* [689.] **

Audubon, vol. vii, p. 100, reports it breeding in Labrador.

687. **Sterna paradisæa** BRÜNN. *Arctic Tern.* [690, 693.] **

Breeds plentifully on islets in Ungava Bay; young of the year and adults and eggs were procured there. Abundant on the other coasts of the country. Known as the "Rittick" at Ungava; an Orkney Isle word.

690. **Sterna antillarum** (LESS.). *Least Tern.* [694.]

Audubon, vol. vii, p. 119, reports it abundant and breeding on western (southern) shore of Labrador.

696. **Megalestris skua** (BRÜNN.). *Skua Gull.* [652.]

A single individual was seen near the vessel, sitting in the water off the north side of the Strait of Belle Isle, June 22, 1882.

697. **Stercorarius pomarinus** (TEMM.). *Pomarine Jaeger.* [653.]

One was shot by Coues, p. 243.

699. **Stercorarius longicaudus** VIEILL. *Long-tailed Jaeger.* [654.]

Coues, p. 243, records having seen this species in Labrador. Not known to enter Hudson Strait.

698. **Stercorarius parasiticus** (LINN.). *Richardson's Jaeger.* [655.]

A single individual was obtained in Ungava Bay in the early part of July. Several were seen. Brewster, p. 395, saw a single individual July 20, near Mingan Harbor.

705. Fulmarus glacialis (LINN.). *Fulmar Petrel.* [635.]**

Not observed in Hudson Strait. Excessively abundant from Cape Chidley to strait of Belle Isle. Thousands were seen in July near the former locality.

[708.] Puffinus kuhli (BOIE). *Cinereous Shearwater.* [651.]

Kumlein, p. 102, reports it common from Belle Isle to Grinnell Bay.

709. Puffinus major FABER. *Greater Shearwater.* [647.]

Kumlein, p. 103, reports it from Belle Isle to Resolution Island.

714. Puffinus stricklandi RIDGW. *Sooty Shearwater.* [648.]

Coues, p. 243, states that he saw, on August 19, 1860, few of this species with individuals of *P. major*.

+ **721. Procellaria pelagica** LINN. *Stormy Petrel; Mother Carey's Chicken.* [645.]

One obtained (middle of July, 1882) 20 miles up the Koksoak River. Another was seen 70 miles up that river, October 9, 1882.

722. Oceanites oceanicus (KUHL). *Wilson's Petrel.* [644.]

Atlantic coast of Labrador; observed mostly in spring and fall, then plentiful.

723. Cymochorea leucorrhoa (VIEILL.). *Leach's Petrel.* [642.]

Atlantic coast of Labrador; observed mostly in spring and fall, then abundant.

732. Dytes auritus (LINN.). *Horned Grebe.* [706.]

A single Grebe was seen in a tide pool at the mouth of the Koksoak River, September 15, 1882. I will not undertake to assert what species it was, as it appeared to be a bird of the year. Stearns, p. 132, reports *Podiceps holbölli* as "not rare in spring and fall. Occasionally breeds." The individual seen by me may have been of this species.

736. Urinator imber (GUNN.). *Loon.* [698.]* **

Occurs in Hudson Strait, east and south shores of Labrador. Specimens procured from Davis Inlet and Rigolet.

738. Urinator arcticus (LINN.). *Black-throated Diver.* [699.]

Stearns, p. 122, records that two specimens were procured off the Labrador coast by one of the French priests at Bersimis. One in 1880.

740. Urinator lumme (GUNN.). *Red-throated Diver.* [701.]**

Very plentiful throughout the county. Eggs, downy young, and adults were procured at Ungava. Known in Labrador as "Waby."

741. Plautus impennis (LINN.). *Great Auk.* [710.]

Supposed to have formerly occurred on the Labrador coast. Undoubtedly extinct now.

742. Alca torda LINN. *Razor-billed Auk.* [711.] **

Not observed in Hudson Strait. Abundant on eastern and southern shores, where it breeds plentifully.

743. Fratercula arctica (LINN.). *Common Puffin.* [715, 716.] **

Plentiful on eastern and southern coast of Labrador, where it breeds. Not known to enter Hudson Strait.

752. Alle alle (LINN.). *Sea Dove; Dovekie.* [738.] * (?) **

Common in Hudson Strait. Winter (December 19, 1882) specimen taken 100 miles up the Koksoak River. Occurs in myriads along the eastern shore of Labrador. Known as the "Bullbird." Breeds plentifully in certain localities not visited by me.

760. Cepphus grylle (LINN.). *Black Guillemot.* [726.] * **

Common in Hudson Strait, east and south shores of Labrador. Breeds wherever found in summer.

——. Cepphus mandtii (LICHT.). *Mandt's Guillemot.* * **

Occurs in Hudson Strait occasionally only, according to my own observation. Plentiful on the eastern coast of Labrador. Specimens procured at Fort George by Drexler, July 17, 1861. Breeds wherever found in summer. Known as "Pigeon" or "Sea Pigeon" on the eastern coast.

763. Uria troile (LINN.). *Common Guillemot.* [729, 730.] * **

Plentiful on eastern and southern coasts of Labrador. Not observed in Hudson Strait.

764*a*. Uria lomvia (BRUNN.) *Brunnich's Guillemot.* [731.] * **

Obtained only from Hudson Strait, where it breeds. Abundant on eastern and southern coasts.

SMITHSONIAN INSTITUTION,

June 22, 1885.

NOTES ON SOME FLORIDIAN LAND AND FRESH-WATER SHELLS WITH A REVISION OF THE AURICULACEA OF THE EASTERN UNITED STATES.

By W. H. DALL.

The shells upon which the following notes are based form part of the collection of the United States National Museum, and were obtained in Florida by myself and by Dr. R. E. C. Stearns, Mr. Henry Hemphill, Prof. A. G. Wetherby, Dr. Velie, and other friends and correspondents of the Museum. No completeness is claimed for them, but it is hoped that the publication of these notes may stimulate others to supplement and correct them, until a more nearly complete knowledge of the mollusk fauna of Florida shall be reached. Additions and corrections will be gratefully received and suitably acknowledged in future publications.

Ampullaria (Pomus) depressa Say. Plate 17, figs. 4, 5.

Ampullaria depressa Say, Long's Exp., p. 264, pl. xiv, fig. 2, 1824. Not of Lamarck.

Ampullaria paludosa Say, New. Harmony Diss., p. 260, 1840.

Ampullaria hopetonensis Lea.

Pomus depressa Binney, L. & F. W. Sh. N. Am., iii, p. 3, 1865.

Silver Spring, Fla., General F. E. Spinner. Mound at Enterprise, Lake Monroe, Dall.

This species is found abundantly in several of the mounds, and often much larger than any recent specimens which have been received so far. It is said that Lamarck's *A. depressa* is a *Natica*, but on the principle that "once a synonym always a synonym," it would perhaps have been better if Binney had not revived the old name, but had retained *paludosa*.

Ampullaria (Pomus) caliginosa Reeve.

Ampullaria caliginosa Rve. Conch. Icon. Mon. *Ampullaria*, fig. 118, pl. xxv, Dec., 1856.

Swamps near Cedar Keys, Hemphill.

This species is distinguished easily from the typical *depressa* by its stouter, higher, narrower shell, smaller aperture, larger umbilicus, thickened peristome, higher spire, much more roundly globose whorls, the posterior angle of the aperture not passing much behind the middle of the body whorl and often in front of it. The shell is much thicker and more solid with a salmon tinge on the margin of the aperture, the surface transversely wrinkled and malleated. The color is generally darker, the operculum is black, not brown, as in *A. depressa*. The species is probably common to Mexico and Nicaragua also, and may have been confounded with *depressa* by collectors. It has been received from Nicaragua, collected there by Bridges, Dall, and Sumichrast, and from Tehuantepec, collected by Dr. Spear, United States Navy.

The name *Pomus* Humphrey has no standing in nomenclature, never

having been described. If it had, it would supersede *Ampullaria* Lamarck, with which it was intended to be coextensive. As a subgenus of *Ampullaria*, for those species with a purely horny operculum, it might be retained, but in that case should be credited to H. and A. Adams, who first defined it.

Vivipara georgiana Lea. Plate 17, figs. 2, 3.

Paludina georgiana Lea, Trans. Am. Phil. Soc., v, p. 116, pl. xix, fig. 85, 1837.
Paludina wareana Shuttleworth.
Vivipara georgiana Binney, l. c., p. 27.

Abundant in the mounds of the Saint John's River region. Living in Lake Monroe, Milner; Lake Ware, Rugel; reaching north to South Carolina and west to Alabama, Binney.

It has been stated that this species is not viviparous, which is perhaps due to the confusion of the ova of some other mollusk with those of this species. The fact should be determined by some resident of Florida, if possible in an aquarium, which would settle the matter. I note considerable variation in the form of the mound specimens.

? **Campeloma lima** Anthony. Plate 17, fig. 1.

Paludina lima Anthony, Proc. Acad. Nat. Sci. Phila., 1860, p. 70;=*Melantho coarctata* Lea teste Binney.

A beautiful shell, strongly marked with revolving striæ, dark olive outside, dark and livid inside, with the whorl appressed toward, but not at, the suture, was sent to the Museum by Professor Wetherby from Indian River and Miami, Fla. It appears to resemble Anthony's *Paludina lima*, and is provisionally referred to that species. Binney's figure of *P. lima* does not agree well with the description given by Mr. Anthony, and the failure of eyesight with which the latter naturalist was afflicted may have led to some error in forwarding a type for figuring. This species is peculiar, as far as I have seen, in its depth of color and livid interior.

The name *Melantho* was applied by Bowdich to a marine fossil from the Paris basin, perhaps a *Lunatia* or *Amauropsis*. It has nothing to do with the group named by Rafinesque *Campeloma*. The identity of *C. lima* with *C. coärctata* Lea is suggested by Mr. Binney, but I prefer to leave that an open question for the present. My remarks apply only to Anthony's description.

Bythinella monroensis Dall. Plate 17, fig. 9.

? *Hydrobia monroënsis* Frauenfeld, Verh. K. K. Zool.-bot. ges. Wien, Apr., 1863, p. 1023.

Shell moderately strong, greenish or brownish, smooth and polished, but usually overlaid with a dull dark brown unpolished deposit; the interior of the mouth whitish; the margin of the aperture nearly black at the extreme edge, not sharp nor much thickened, not reflected; the peristome complete, just touching the body whorl in the adult, adherent in the young; whorls five or six, rounded, smooth or lightly transversely striate, anterior part of peristome slightly projecting, outer posterior

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part a little flexuous, aperture rounded behind or not angular, inner lip somewhat arched; umbilicus small; apex rounded; operculum dark brown, subspiral, longitudinally spirally striate inside; animal whitish marbled with black or dark gray; eyes large, black; tentacles moderate, blunt at the tip; a whitish streak behind them; foot bluish white, muzzle dark, with an indentation in the median line; dentition much like that of *B. nickliniana* Lea, the rhachidian tooth proportionately wider and larger; the first denticle on the inner edge of the cusp of the first lateral tooth large and prominent, and the tips of the outer laterals with one or two well-marked denticulations. Lon. of shell 3.6 to 4.8^{mm}; max. lat. 2.0 to 3.0^{mm}; aperture from a little more than one-third to a little less than one-half as long as the shell.

Habitat.—Brook flowing from Benson's mineral spring into Lake Monroe, at Enterprise, Fla.

This shell resembles closely the stouter specimens of *Pomatiopsis lustrica* Say, but is less acutely pointed and has one whorl less; the soft parts, on the other hand, are like those of *Bythinella nickliniana* Lea. There is reason to believe that it is identical with the species described by Frauenfeld as above mentioned, probably from the same locality, in Mus. Cuming. It was also collected near Lake Monroe by Shuttleworth, whose specimens are in the Imperial Museum at Vienna. This and several other American species described from Shuttleworth's collections by Frauenfeld seem to have escaped the notice of American writers on the *Hydrobiinæ*.* There is a noticeable difference in form, indicated in the measurements above, among the specimens collected by me, which seems to be sexual. Unlike Stimpson, I found the stout ones to be invariably females. Every grade, however, existed between the very stout and the most elongated. They were found on floating wood and leaves of plants in quiet places in the little shallow brook associated with *Limnæa columella*, *Ancylus* and *Planorbis*, exclusively under water.

Amnicola floridana Frauenfeld.

> *Amnicola floridana* Frauenfeld, l. c., 1863, p. 1028 et 1865, p. 529, pl. x, fig. 4, *a–b*.
> *Bythinella obtusa* Lea, Dall. Proc. U. S. Nat. Mus., 1883, p. 334.

Owing to misinformation, I was led, in my paper on Hemphill's shells in 1883, to place the above species (whose generic place is still unsettled)

* *Hydrobia corrigata* Frauenfeld, l. c., pp. 1021–2, received from Boston, Mass., under the name of *Cingula minuta* Totten, but according to Frauenfeld not that species. It is further referred to and figured, l. c., 1865, pp. 525–6, pl. viii, fig. 3, *a–b*. *Hydrobia Seemani* Frauenfeld, l. c., p. 1025, 1863, p. 525, 1865, pl. viii, fig. 1, *a–b*, is recorded as collected in Northwest Mexico, Durango, by Seemann, and the types are in Mus. Cuming. *Amnicola Schrökingeri* Frauenfeld, l. c., 1863, p. 1030, and 1865, p. 528, pl. x, fig. 2, *a–b*, is described from Massachusetts specimens named "*lustrica* Say," in Mus. Cuming. *Amnicola cincinnatiensis* Anthony, is mentioned as being the *Paludina truncatella* Ziegler MS. from New Orleans, in Mus. Cuming. Others are referred to elsewhere in the present paper.

under the name of Lea, to whose figure it bears a certain resemblance. My attention was called to the matter by Mr. R. Ellsworth Call, and on investigation I found that the species generally known as *B. obtusa* Lea, though nearly twice the size assigned it in Lea's description, is nevertheless probably correctly identified. The Florida species is more acute and much smaller. Frauenfeld records it from East Florida in Mus. Cuming. Hemphill obtained it living in the creek at Jacksonville and dead in the salt ponds at Key West, where it may have been drifted. Stearns collected it in a spring 1 mile from Tampa. The specimens are accurately represented by Frauenfeld's figure, though larger than he indicates. The present identification is therefore probably correct. It does not seem to have any American synonym. He also records *A. porata* Say (l. c., p. 1030) from Smyrna, East Florida.

Hydrobia? Wetherbyi, n. s. Plate 17, fig. 10.

? *Amnicola nutalliana* Frauenfeld, l. c., 1863, p. 1029.

Shell short, stout, obtuse, polished, greenish gray, with four and a half whorls, slightly striated in both directions, umbilicus reduced to a mere groove behind the lip; whorls rounded, the last much the largest; suture distinct; aperture ovoid, entire, bluish white within, with a dark margin outside, slightly thickened, not reflected; plane of the aperture somewhat oblique, not waved; aperture slightly smaller than the whorl immediately behind it. Lon. 7.0, max. lat. 5.0, max. lon. of aperture 3.5^{mm}. Operculum subspiral, light horn colored.

Habitat.—Lake Eustis, Florida, Wetherby. Mus. Cat. No. 32123.

This interesting shell was communicated to me by Mr. Wetherby, who has examined the soft parts, which appear to locate it in the genus *Hydrobia*, as understood by European authors. The notes made by him on his dissections of the soft parts have not reached me owing to his absence in Europe. It is not improbably the shell mentioned by Frauenfeld, under the name of *A. nuttalliana* as collected by Shuttleworth at Silver Spring on the Oclawaha and at Fort King, East Florida. It bears, however, only a very slight resemblance to the true *Nuttalliana*, which is a species of the Pacific slope.

Goniobasis Etowahensis Lea. Plate 17, fig. 7.

Melania Etowahensis (Lea) Rve. Conch. Icon. *Melania* sp. 426, May, 1861. *Not of* Lea, Proc. Acad. Nat. Sci. Phil., 1862, p. 264.

Goniobasis Canbyi Lea, l. c., p. 271, 1862. *Not of* Tryon, L. and F. W. Sh. N. Am., part iv, p. 260, 1873 (= *Etowahensis* Lea *non* Rve.).

Goniobasis Etowahensis, Tryon, l. c., p. 148, 1873.

? *Melania papillosa* Anthony, Rve. Conch. Icon. Mon. *Melania*, sp. 467, 1861.

Abundant in the mound at Enterprise and on the beach washed from the mound. This was the original locality where it was obtained by Mr. Canby. I did not find it living, the season being perhaps too early. It has been found living in the Etowah River, Georgia, and the Tennessee River. Tryon suggests the identity of *G. papillosa* Anthony, with the present form, which, as shown by the mound specimens, is most vari-

able in sculpture. It was the only Melanian observed in Florida during my journey.

Neritina reclivata Say. Plate 17, fig. 8.

Neritina reclivata (Say), Reeve Conch. Icon. fig. 34, *a-b*, Oct. 1855.
Theodoxus reclivatus Say, Journ. Acad. Nat. Sci. Phila., ii, p. 257.
Neritina microstoma D'Orbigny, Moll. Cuba, ii, p. 48, pl. xvii, fig. 36, 1842.
Neritina floridana Shuttleworth, in Reeve Conch. Icon., fig. 85, Nov., 1855.
Neritella reclivata Binn. L. and F. W. Shells of N. Am., III, p. 103, 1865.

This shell was originally collected by Say from the Saint John's River, Florida, where it is still abundant. Specimens have been received from General F. E. Spinner and others. Further south they are smaller, darker, and less often eroded. They have been collected at the mouth of the Manatee River by Colonel Jewett; at Tampa by Stearns, Jewett, and Hemphill; in Cuba, by Arango; Jamaica, by Governor Rawson, and are reported from Martinique by D'Orbigny. Some quite small specimens from a brook near Palma Sola were obtained by Mr. I. Greegor, of Jacksonville, which at first sight appeared quite distinct, being black, with a cerous labrum, but the light zigzag lines, characteristic of some color varieties of *reclivata*, were beautifully clear by transmitted light. These shells attained a maximum length of 1 centimeter (0.4 inch), and were, except in color, identical with *N. reclivata*, of the same size. To distinguish them, if thought desirable, they might take the varietal name of *N. reclivata*, var. *Palmæ*. The Antillean *microstoma* is identical with *reclivata*, the colors being sometimes a little brighter, but there is no other difference of any sort. There are several other Antillean forms which are extremely close to our species, and may eventually prove mere local varieties of one species. The name *Neritella*, adopted by H. and A. Adams from Humphrey, and applied by Binney to the various American Neritinæ, has no standing in nomenclature and was never described.

Neritina viridis Linné.

Nerita viridis L., Syst. Nat., ed. xii, p. 1254, 1767.
Neritina viridis Lamarck, An. s. Vert., vi, 2, p. 188.

Common throughout the Antilles in salt water. Rare among seagrass at low water, Key West, No Name Key, Hemphill. I believe this species has not before been reported living on the coast of the United States. It is, perhaps, the most unmistakable species of the group.

Neritina virginea Linné.

Nerita virginea Lin., Syst. Nat., ed. xii, p. 1254, 1767.
Neritina virginea Lam., An. s. Vert., vi, pt. ii, p. 187, 1822.

Habitat.—All the Antilles, D'Orbigny; among mangroves at high water, No Name Key, Florida, Hemphill.

Mentioned by D'Orbigny but not by Binney as Floridian.

Glandina truncata Gmelin.

Banks of the Saint John's River at Jacksonville and Palatka, Dall. A beautiful pink variety at Enterprise, on Lake Monroe; the variety *parallela* Binney, at Marco, H. Hemphill; &c.

The specimens found in April were all young, much smoother and more pellucid than the adult, and only about 25.0mm long. I have never seen adult specimens 4 inches long, such as Mr. Binney describes, from the Everglades, and should be glad to have some for the collection. They are very rapacious and will swallow a good sized *Helix septemvolva* without difficulty; a large number have been found packed into the stomach of one individual. None have been found in the Indian mounds, and perhaps they are not eatable. Those collected by me were always in moist places and exuded a very copious and adhesive mucus on being disturbed.

Melaniella gracillima Pfr.

Stenogyra (Melaniella) gracillima (Pfr.) Binney, L. and F. W. Shells of N. Am., i, p. 232, 1869.

Achatina gracillima Pfr., Wiegm. Arch., 1839, p. 352.

Achatina striato-costata D'Orbigny, Moll. Cuba, i, p. 176, pl. xi, figs. 19–21.

Habitat.—Cuba; Bahamas; Saint Thomas, West Indies; Florida Keys and near Miami, Binney; Key West, No Name Key, Hemphill, 1884.

This species appears to be rather rare in Florida.

Bulimulus multilineatus (Say).

Bulimuls multilineatus Say, Journ. Acad. Nat. Sci., v, p. 120, 1825.

Bulimus menkei Gruner, Wiegm. Arch., 1841, p. 277, pl. xi, fig. 2.

Bulimus menkeanus Melvill, Journ. Conch. Leeds, 1881.

Bulimus venosus Rve., not of Ferussac, Conch. Icon. sp. 285, 1848.

Habitat.—New Granada; Venezuela; Marco Id., Florida, Dr. Velie; Florida Keys, Wurdeman; Key West, Melvill.

This beautiful species appears to be quite rare. Its geographical distribution is very remarkable, and any information as to its distribution in Florida would be very useful.

Bulimulus marielinus Poey.

Bulimulus marielinus Poey, Memorias, i, p. 212, 447; ii, pl. xii, figs. 32–3. Binney, l. c. i, p. 194.

Habitat.—South Florida, Cooper; St. Kitts, Rawson; Upper Matacumba Key, Hemphill (rare, on bushes).

The first definite locality, named for this species in Florida.

Pupa incana Binney.

Key West, Hemphill, and also Melvill (as *P. maritima*, Pfr.)

This species varies greatly in form, proportions, and even to some extent in color. A number of specimens lived in a tightly-corked tube for more than a year and are still alive.

Pupilla pentodon Say.

Vertigo pentodon Say, Journ. Acad. Nat. Sci. Phil., ii, p. 476, 1822.

Pupilla pentodon Tryon, Am. Journ. Conch., iii, p. 303, 1868.

Found under the bark of a prostrate oak tree in the vicinity of a pool at Archer, Alachua County, Florida, April, 1885, by W. H. Dall. About a dozen specimens were collected with other small species in about an hour.

It should be observed that in the sandy region of North Florida there

are absolutely no mollusks in the pine woods or away from water or moist earth. The clumps of hardwood around the "sinks" or natural wells of the region, called there "oak hamaks," are usually well populated with snails, though there may be only minute ones; but a few steps away among the pines the most ardent collector will find nothing. In the "sinks" *Planorbis trivolvis* and *Physa heterostropha* are always to be found, but nothing else, at least in any of those I visited. Those sinks in which the water stands near the level of the soil may have more mollusk inhabitants. On the moist soil around the sinks the Polygyræ of the *auriculata* type find congenial surroundings. The *cereolus* type of *Polygyra* seems to prefer the shores of lakes or beaches near the sea, in general warmer spots than the others. The smaller forms, *Pupilla*, *Vertigo*, *Zonites*, *Strobila*, &c., are best found by carefully scanning the inner surface of loose bark on some prostrate hardwood tree, and that of the wood opposite. Here these small folk live and enjoy life after their fashion, finding coolness, moisture, and the mycelium on which they chiefly feed. By rolling over the log when the bark has been thoroughly scanned, some of the larger forms (as well as a snake or two) will probably be found. By gathering a large bagful of the moist dead leaves from near the hardwood trees, drying them and shaking them a handful at a time in a large paper bag, in the dust and débris which will accumulate in the bottom of said bag, the collector will usually find his reward.

The present species does not appear to have been recorded from Florida, though known from Northern Georgia and Mississippi.

Pupilla fallax Say.

Pupa fallax Say (1821), Binn. Terr. Pulm. of the U. S., v, p. 202, 1878.

Egmont Key, Fla., Col. E. Jewett.

Pupilla contracta Say.

Pupa contracta Say (1822), Binney, l. c., p. 207.

Habitat.—Eastern United States, Binney; Archer, Alachua County, Florida, Dall, in oak hamaks, under bark, April, 1885; Tampa, Stearns and Jewett; Samana Bay, Dominica, officers of the United States Navy.

Pupilla rupicola Say.

Pupa rupicola Say (1821), Binn., l. c., p. 208.

Abundant at Tampa, Stearns and Hemphill; Key West, Binney; Enterprise, Lake Monroe, Dall.

This species seems quite constant in its characters.

Pupilla floridana n. s. Plate 17, Fig. 11.

Shell greenish spermaceti-white; when living the tissues of the animal show with pale salmon color through the shell in the apical whorls; surface smooth or lightly striated, with a tendency to retain dirt upon itself; form subcylindrical, with a rather obtuse apex, the last whorl forming nearly half the shell; suture evident; whorls five, neatly rounded; aperture longer than wide; lip white, thin reflected; teeth,

about 9, of which there are generally 3 larger than the rest, their tips nearly meeting and their bases mutually nearly equidistant; one is on the pillar, one on the body whorl, and one on the anterior margin; on either side of the latter are two generally subequal much smaller denticles. Lon. 1.60, lat 0.75^{mm}.

Habitat.—Under loose oak bark, oak hamak, Archer, Alachua County, Florida, April, 1885, W. H. Dall, sixteen specimens.

This is one of our smallest species and is related to *P. pentodon* and *P. pellucida.* It is about half the size of the former and much more slender. Its teeth recall those of *P. curvidens* Gould in their arrangement, but the shell is more cylindrical and smaller, as it is than in *P. pellucida* (*servilis*) as figured by Gould. The teeth are more numerous than in the latter shell, and set, as in *P. pentodon,* in one series; not, as in *pellucida*, partly deeper in the throat.

I describe this with some hesitation, for the condition in which the Pupidæ and Vertigos of North America are is most unsatisfactory and offers an excellent field to some careful student who shall be able to examine and figure large series of authentic specimens. Still, as there is absolutely no other form with which I feel able to unite this one, it is better to give it a name than to leave it erroneously with some other species.

Vertigo ventricosa Morse.

Isthmia ventricosa Morse, Ann. N. Y. Lyc. Nat. Hist., viii, p. 1, figs. 1–3, 1865, Binney, l. c., p. 218.

Six specimens of a small Vertigo were found under the bark of a decaying oak log at Archer, Alachua County, Florida, and two others on dead leaves at Enterprise Lake, Monroe, Fla., which seem referable to this species. They have, however, six or seven teeth like *V. ovata* Say, while the dimensions are those of Morse's species. Two of them are so enrolled that only one whorl above the body whorl is visible except from above, as if the apex had been crowded vertically downward. Similar distortions are not very uncommon among these small shells. In this connection Mr. Binney's figure of *Pupa alticola* Ingersoll (l. c., p. 212, fig. 116) may be noticed. While it doubtless represents the specimen figured, there is equally no doubt that that specimen was abnormally distorted. Specimens marked typical by Mr. Ingersoll in the museum collection do not show any such disproportion in the last whorl, though there is visible a slight constriction of the last whorl but one, in many individuals of this species, as well as in many full grown specimens of *Vertigo simplex* Gould, with which it is probably synonymous.

Strobila labyrinthica Say.

Helix labyrinthica Say, Journ. Acad. Nat. Sci. Phil., vol. i, p. 124, 1817.
Strobila labyrinthica Morse, 1864, Binney, l. c., p. 259, 1878.
Helix Strebeli Pfr., Mal. Bl., 1861, p. 71, pl. 1, figs. 5–8.

Habitat.—Mirador, Vera Cruz, Mexico, Pfr.; Eastern United States, Binney; Florida, Jewett, Stearns; Sarasota Bay, Florida, Hemphill;

Archer, Alachua County, Florida, Dall; Porto Cabello, Venezuela, Sumichrast [var. *Morsei*].

The species was very abundant at Archer, under the bark of decaying logs, the color was especially fine, the lip and lamella deep rose color, verging on claret color in some specimens; the costæ sharp, the last whorl subcarinate with the ends of the costæ pointedly produced in many individuals. A comparison with a typical specimen of *S. strebeli* Pfr. establishes their identity. A form of this species has been sent to the museum by Professor Sumichrast, from Porto Cabello, Venezuela, which differs from the type in wanting the costæ, the whorls being only lightly transversely striate, rather flat and appressed, with the basal periphery particularly angular, and the umbilicus slightly smaller than in *S. labyrinthica*. This may take the varietal name of *S. Morsei* in honor of Prof. E. S. Morse, who established the genus. It is slightly larger than the Mexican specimens. In all other characters it agrees with American specimens from the Eastern United States.

Strobila Hubbardi Brown.

Helix Hubbardi Brown, Proc. Acad. Nat. Sci. Phil., 1861, p. 333, Binney, l. c., p. 261, fig. 153, 1878 [as *Strobila*].

Helix Vendryesiana Gloyne, Journ. de Conchyl., vol. xix, p. 333, 1871.

Habitat.—Indianola, Tex.; Savannah, Ga.; Jamaica, West Indies (Gloyne); Archer, Alachua County, Florida, Dall. Two dead specimens were found under decaying bark in an "oak hamak," at Archer. This is the first time it has been reported from Florida, but it will doubtless be found eventually over the entire southern region.

Helix (Polygyra) auriculata Say.

Polygyra auriculata Say (1818), Binn., l. c., p. 264.

Habitat.—Saint Augustine and the basin of the Saint John's River, Binney; Fort George Id., and the Keys, Jewett; Tampa, Stearns. Variety *microforis* Dall, Johnson's Sink, Alachua County, Dall.

This form is quite well marked and when fully adult shows as a rule little variation from the form figured by the Binneys and generally regarded as typical. A quite uniformly characterized variety was found, however, by me at Johnson's Sink, Alachua County, where it was abundant. Some twenty specimens were picked up in a few moments during a hurried visit made with other ends in view, and a quart could easily have been gathered in half an hour. This form is distinguished by its generally smaller size (max. diam. 12.0, min. diam. 10.0, alt. 6.0 mm.) as compared with the type (15.0, 12.0, and 7.9 mm.) and by being more closely rolled, thus having not only an actually smaller umbilicus, but one in which one-third less of the preceding whorl is visible. The specimens were uniform in this, and in all other respects were like the typical *auriculata*.

Helix (Polygyra) uvulifera Shuttleworth.

Helix uvulifera Shuttlw., Bern. Mitth., 1852, p. 199, Binney, l. c., p. 264-5.
Helix florulifera Reeve, Conch. Icon., *Helix*, No. 699.

Habitat.—Florida Keys, Binney, Stearns, Jewett, Hemphill, and others.

This is a much more variable form than the preceding, both in absolute size and in proportions; a small variety from Sanibel Key, collected by Hemphill, is less than half the size of ordinary specimens and has a smaller umbilicus in proportion, but the variations of this species are so numerous as to render it undesirable to apply names to them.

Helix (Polygyra) Postelliana Bland.

Helix Postelliana Bland (1858), Binney, l. c., p. 268.

Habitat.—Sea islands of South Carolina, and Georgia, main land of Georgia, Baldwin; Florida, Binney; Jacksonville, Stearns; South Florida, Jewett.

This species varies considerably in size like *uvulifera*, but its proportions seem more constant.

Helix (Polygyra) auriformis Bland.

Helix auriformis Bland (1858), Binney, l. c., p. 265.

Habitat.—Georgia to Texas, Binney; New Orleans, Hemphill; Indian Territory, Stearns.

The last is a new locality for this species.

Helix (Polygyra) avara Say.

Polygyra avara Say (1818), Binney, l. c., p. 268.

Habitat.—Basin of the Saint John's River, Florida, Remington Landing (Say); Jacksonville, Hemphill; bank of the river at Palatka, April 10th, Dall.

This is a rare species. Those found by me were partly immature owing to the early part of the season in which my visit was made; the specimens were found singly under chips or pieces of board on the river bank in very wet places. That it has been so rare in collections is due, probably, in part, to the fact that the shell hardly comes to maturity before most visitors have left Florida and occupies situations where the rains would wash dead shells into the river. Both animal and shell are very dark colored.

Helix (Polygyra) Jacksoni Bland.

Helix Jacksoni Bland (1866); Binney, l. c., p. 275.

Habitat—Indian Territory (Cherokee Nation) near Fort Gibson, and Springfield, Mo., Binney, l. c.; Florida, Bland, in Stearns's collection now in United States National Museum.

The latter locality is new and far removed from those previously published. I do not know from whom Mr. Bland got it.

Helix (Polygyra) cereolus Muhlfeld.

Helix cereolus Muhlf., Berl. Mag., viii, p. 11, pl. 2, fig. 18, Jan., 1818.
Helix planorbula Lamarck, An. s. Vert., vi, part 2, p. 89, No. 86, 1822. Ed. Deshayes, vol. viii, p. 67, 1838.
Polygyra septemvolva Say, Journ. Acad. Nat. Sci., I. p. 278, June, 1818.
Helix volvoxis Parreyss (MSS.), Pfr. Sym., iii, p. 80, 1846.
Helix microdonta Deshayes, in Fér. Hist. Nat. Moll. Ter., p. 6, pl. 72, fig. 13, 1839.
Helix plana Dunker, in Phil. Abb. und Beschr, i, p. 51, pl. iii, figs. 11, *a. b. c.* Oct., 1843.
Helix Carpenteriana Bland, Ann. Lyc. Nat. Hist. N. Y., viii, p. 137, 1858; Binney, l. c., p. 284 (*Polygyra*).
Helix Febigeri Bland, Am. Journ. Conch., II, p. 373, pl. xxi, fig. 10, 1866. Binney, l. c., p. 285 (*Polygyra*).
Helix delitescens Shuttleworth, Pfr. Nomencl. Hel., p. 109.
Helix polygyrata Pfr. (non Binn.), Mon. Hel. Viv., i, 409, 1848.
Helix cheilodon "Say," Pfr. Nomencl. Hel., p. 109. (Ubi ?)

Habitat.—Georgia, Florida, Alabama, Mississippi, Louisiana near the sea; Bermuda, Bahama Islands, but not in Cuba.

This protean species has received many names and presents many varieties, as well as individual variations, which, were they constant, would fairly be entitled to distinct names. After examining many specimens, most of them typically identified by Messrs. Binney, Bland, and Lewis, I have come to the conclusion that neither the soft parts nor the shell offer such distinctions as should entitle these variations to specific rank. All the various characters mentioned as distinctive in the diagnosis of various authors, when a sufficient number of specimens from a sufficient number of localities are compared, are seen to fade into one another and leave no line of demarkation. I do not wish to be understood as criticising the labors of those who have worked with insufficient material and have applied names to what seemed at the time to be distinguishable and definable forms. It is one of the stages in the progress of science which must be expected, and through which every branch of systematic zoology has passed or is passing. The revival of science under the new light which modern research has thrown upon it, the recognition that species are but terms of a more or less continuous and interlaced series, and not sharply characterized individualities, and the investigation of changes concurrent with differences of environment and geographical distribution have altered the whole basis of systematic zoology. The result at first seems chaotic, but the recognition of the state of things is the first step out of confusion. The so-called "new school" conchologists of France find their way out by naming every possible combination of variations, and, were the capacity of the human memory without limit, this would be one way out of the dilemma. Unfortunately this is not the case, and the probable result, were the process carried to its conclusion in the whole field of malacology, would be "confusion worse confounded." We should need endless indices to the index. Specific names must always resemble the

beads on a string, all forming part of one necklace. When, by study of the conditions with which we find certain characters associated, we shall come to understand why a certain shell in one place is coarsely striated, in another nearly smooth; here carinate and there rounded; here elevated and there depressed; then we shall begin to grasp the thread connecting the whole series and to have a scientific basis for our systematic arrangement which will replace that which is now disintegrating. That we shall reach such a basis there are strong reasons to hope, and with less delay than would at first sight seem possible.

The group of related forms for which *cereolus* Muhlfeld is the oldest name, exemplifies the law that where any character or organ exists in unusual duplication it is more liable to variation than where it is less numerously developed. The number of whorls is unusually large and also quite inconstant. The spire may be moderately elevated or even concave; the base may exhibit more or fewer whorls; the central umbilical pit be more or less funiculate; the striæ above weaker or stronger; the periphery nearly circular or quite gibbous; the vertical diameter may vary 100 per cent.; the parietal lamina (as pointed out by Tryon) may be present or absent, and the angle of the aperture with the axis varies widely.

The shell generally has from five to seven well marked whorls; but, under especially favorable conditions, as near the walls of Fort Marion, at Saint Augustine, it may have ten or twelve. The number exhibited on the base is absolutely inconstant when specimens from various localities are compared. Only by breaking into the last whorl can it be determined whether the parietal lamina exists. In specimens labelled *septemvolva* by Mr. Binney I have found it, and it is often absent in what is otherwise typical *cereolus*. The soft parts in all are very uniform. The chief forms may be distinguished as follows:

1. *H. cereolus septemvolva.*
2. *H. cereolus laminifera.*
3. *H. cereolus microdonta.*
4. *H. cereolus cereolus.*

No. 1 is extremely depressed, thin, flat, with a carina on the upper edge of the last whorl; moderately strong sculpture above and the reflection of the tip narrow. Lamina usually absent. This is what Mr. Binney, in naming the Smithsonian shells, has considered to be the typical *septemvolva* of Say, though Say's diagnosis would not distinguish his shell from other varieties except the next one. It is more restricted in range than most of the varieties and has been reported chiefly from Florida. It does not exceed 10^{mm} in maximum breadth, except in very unusual instances, and generally averages less.

The large form figured and described by Binney (Terr. Airbr. Moll., p. 281) is not that described by Say in his original diagnosis, though the shell described by Say might perhaps have been closely related to it. His types were 0.3 and 0.4 inch in diameter, or 10^{mm} to the 15^{mm} form figured by Binney.

No. 2 is the form figured by Binney as *Polygyra cereolus*, large, high, with strong upper sculpture, broad lip, the base with the last three whorls obvious, the internal lamina strong. It was called *laminifera* by Binney in 1858. The type of Mühlfeld was like the ordinary small Georgian form about 8.5^{mm} in diameter. Inhabits East Florida and the Keys. Hemphill states that at Long Key these inhabit low moist ground covered with tall grass, so near the sea that unusually high tides sometimes kill them by thousands.

No. 3. This is the small common form with comparatively delicate upper sculpture, rather flat, horny looking, very smooth below, the lip narrow and delicate, the mouth small; the last two whorls most obvious below. It is often a little gibbous, and in most cases has a delicate internal lamina. It is *carpenteriana* Bland in part; *microdonta* Deshayes; *delitescens* Shuttleworth; and is very generally labelled *volvoxis* Parreyss. It is the form found at Bermuda and the Bahamas, is common on the Florida Keys, and reaches to the westward as *H. Febigeri* Bland.

No. 4. This is like the last but stronger, more shelly looking, coarser in sculpture, proportionally larger every way, and is the most common and widely distributed continental variety. It probably develops into No. 2 in favorable situations.

There are many intermediate stages between all these forms. The careful study which shall reveal the true relations of each to the other is only possible for a resident in the region itself. No more interesting and valuable contribution to our knowledge could be made than this. One such study, if it were only thorough and careful enough, and embraced a sufficient range of habitat, would be a Rosetta stone, affording a key to interpret the mysteries of many others. Shall not the South afford us a conchological Champollion? As for the subgeneric names used in this connection it is quite evident to every one who surveys the situation in the light of the changes made by authors from time to time, that such names as *Polygyra*, *Dædalocheila*, &c., are merely of sectional importance. They have a certain convenience in the literature, but correspond more to a general facies than to any clearly definable characters. This, of course, does not apply to groups formerly included in the genus *Helix* but now shown to differ structurally, such as *Zonites*, *Stenopus*, *Nanina*, &c. The distinctions, except in general facies, between *Mesodon*, *Triodopsis*, *Stenotrema*, *Dædalocheila*, *Polygyra*, &c., are impossible to formulate and do not exist in nature any more than distinctions between individual waves of the sea, which, nevertheless, are visible to all beholders. When these facts are fully recognized, a great step toward a scientific comprehension of genera and species will have been gained.

Helix (Polygyra) pustula Férussac.

Helix pustula Fér., Hist., p. 50, pl. 1, fig. 1. Binney, l. c., p. 286. (*Polygyra*.)

Habitat.—South Carolina, Georgia, Florida to Texas, Binney; Cedar Keys, Stearns and Hemphill; Tampa City, Bland.

Helix (Triodopsis) inflecta Say.

Helix inflecta Say (1821), Binney, l. c., p. 306. (*Triodopsis.*)
? *Helix rugeli* Shuttleworth, 1852.

Habitat.—Interior region, Texas to New York, sea islands of Georgia to the Northwestern States, Binney; Florida, Bland, in Stearns's coll.

The three specimens received from Mr. Bland vary from 0.85 to 0.12^{mm} in maximum diameter, also in elevation and aperture. One has the tooth deep, as in *H. rugeli;* one medium; the third as in Binney's figure of *inflecta.* Not previously reported from Florida.

Helix (Triodopsis) vultuosa Gould.

Helix vultuosa Gld. (1848), Binney, l. c., p. 312.

Habitat.—Arkansas and Texas, Binney; Florida, at Pensacola, Wetherby.

Not previously reported from Florida.

Helix (Triodopsis) Hopetonensis Shuttleworth.

Helix Hopetonensis Shuttlew. (1852), Binney, l. c., p. 311.

Habitat.—South Carolina to Fort George, Saint John's River, Florida, Binney; Fernandina and Cedar Keys, Hemphill.

Helx (Mesodon) jejuna Say.

Helix jejuna Say (1821), Binney, l. c., p. 151.

Habitat.—Tampa, Hemphill; East Florida, Binney.

This seems, on the whole, distinguishable from *Mobiliana*, which is also reported by Jewett from Jacksonville.

Helix (Microphysa) vortex Pfr.

Helix vortex Pfr. (1839), Binney, l. c., p. 171.
Helix selenina Gould, 1848.

Habitat.—Southern Florida, Binney; Marco, Fla., Hemphill; said to be viviparous, a fact worthy of verification.

Guppya gundlachi (Pfr.), Tate.

Helix gundlachi Pfr., Wiegm. Arch., 1840, 1, p. 250.
Helix pusilla Pfr., l. c., 1839; not of Lowe.
Conulus gundlachi Tryon, Am. J. Conch., 1866, ii, p. 256.
Guppya gundlachi Tate, Am. J. Conch., v, p. 155, 1870.
Zonites gundlachi (Pfr.) Binney, Bull. M. Comp. Zool., iv, p. 127, pl. xxii A, fig. 3, 1878.

Habitat.—Antilles (Cuba, Guadalupe, &c.); Nicaragua; Florida Keys; Archer, Alachua County, Florida.

This remarkable little shell looks like a rather rude specimen of *Conulus chersina* Say, with inflated dome-like whorls and a well-defined perforate umbilicus. It lives in moss on trees and dead stumps (of hard, not resinous, wood), is viviparous, has the tip of the tail subtruncate with a large mucus pore and above the latter a projecting point of integument. The external features of the soft parts have been described by Tate; the dentition has been shown by Binney to resemble that of

Guppya vacans; the inner four or five true laterals having an accessory cusp on each side of the main point of the tooth while the uncini are bluntly bi- or tridentate as in *Nanina* and *Vitrinoconus.* The present station is the most northern recorded in Florida. The specimens collected happened to be all destitute of the soft parts, though mostly in fresh condition.

Zonites sculptilis Bland.

Helix sculptilis Bld. (1858), Binney, l. c., p. 110.

Habitat.—Cumberland Mountain region, Binney; Waco, Tex., Hemphill.

This species has not yet been found in Florida, but the above extension of its range is so important as to warrant a notice of it. It was collected by Mr. Hemphill while returning from his Florida trip.

Zonites (Hyalina) arboreus Say.

Helix arborea Say, 1817, Binney, l. c., p. 114.

Archer, Alachua County, Florida, and also at Enterprise on Lake Monroe, Dall; Cedar Keys, Fla., and New Orleans, La., Hemphill.

Zonites (Hyalina) indentatus Say.

Helix indentata Say (1822), Binney, l. c., p. 116.

Enterprise, Lake Monroe, Florida, Dall; Florida, Stearns, Jewett, and others.

Zonites (Hyalina) radiatulus Alder.

Helix radiatula Alder, Cat. North. and Durh., p. 12, No. 50, 1830.
Helix striatula Gray, non Linné, nec Muller; undescribed.
Helix nitidosa Férussac; undescribed.
Helix electrina Gould, Inv. Mass., p. 183, fig. 111, 1841.
Helix pura Pfeiffer, Binney, non Alder.
Helix viridula Pfeiffer *ex parte*, 1848; non 1881; Binney apud Pfeiffer, non Menke.
Helix hammonis Westerlund, Mörch, Pfeiffer (1881); doubtfully of Ström, 1795.

Habitat.—North America (except in the Californian region) in suitable localities; Florida, Stearns, Jewett; Enterprise, Lake Monroe, Florida, Dall.

A comparison with typical examples of Alder leaves no doubt that the American shell known as *Helix electrina* of Gould is identical with it. The *H. pura* of Alder is a different thing altogether. The *viridula* of Menke, if referable at all to *radiatula*, is a variety of it not found in America, and Menke's name was probably not prior to Alder's, being published almost simultaneously. The *H. hammonis* of Ström, described from Trondhjem, Norway, in 1795, has been referred to a number of small species, and cannot be said to be definitely identified with either. It seems about time that the American shell was called by a name which, without any doubt, belongs to it. It has a most extraordinary range; the Museum possesses specimens from Point Barrow, the extreme northwest point of the continent; from Florida, the southeast extreme, and

from Ungava nearly the extreme northeastern limit of America. All these, and many from intermediate points, preserve their characters with great uniformity.

Zonites (Hyalina) minusculus Binney.

Helix minuscula Binney, Bost Journ. Nat. Hist., iii, p. 435, pl. 22, fig. 4, Nov., 1840? W. G. Binn., l. c., p. 118.
Helix apex C. B., Ad. Contr. Conch., p. 36, Oct., 1849, fide Binney.
Helix Lavalleana D'Orbigny, Moll. Cuba, 1, p. 161, pl. viii, figs. 20–22, 1841.*
? *Helix saxicola* Pfr., Wiegman's Arch., i, p. 251, May, 1840.
Helix mauriniana Binney, Pfeiffer, *ex parte non* Orbigny.
Helix minutalis Morelet, Test. Nov. Cub., ii, p. 7, 1851, non Férussac.

Habitat.—North America, from the Red River of the North to Yucatan and Florida, Binney; Jamaica, C. B. Adams; Cuba, Pfeiffer and D'Orbigny; Japan, Bermuda, and Porto Rico (Binney, l. c.); Archer and Enterprise, Fla., Dall; Tampa, Fla., and New Orleans, La., Hemphill; Porto Cabello, Venezuela, Sumichrast, in U. S. Nat. Museum.

This widely-spread and well-known little species has been collected by Professor Sumichrast, much further south than previously reported with other Venezuelan species on the highlands near Porto Cabello. I found it in Florida abundantly in the same locality as other small species under the bark of decaying logs, &c. A form of it which, at first sight, looks different from *minuscula* is rather larger than usual and above shows no differences. On the base in the type the junction of the inner lip with the body whorl takes place, following the course of the whorl, inward from the middle line of the base of the whorl and generally about the inner third. This gives a peculiarly thimble-shaped umbilicus. In the variety under consideration the above-mentioned junction takes place outside of the middle line or even at the outer third, while the aperture is a little dilated. The result of this is to show a much larger portion of the base of the penultimate whorl and to alter the facies of the umbilicus. For this form, found in Alachua County, Florida, I would suggest the varietal name *alachuana.*

There is a curious tangle in regard to the name of this species. In the second number (May) of the descriptive, or first volume, of the Archiv für Naturgeschichte, Dr. Pfeiffer described, in 1840, a small *Helix* from Cuba under the name of *saxicola.* The year before he had described another under the name of *Helix Boothiana*, which afterward became the type of the subgenus *Microphysa.* Dr. Amos Binney read his description of *Helix minuscula* in November, 1840, but the part of the journal in which it was printed contains papers which were not read until February, 1841, and was probably published in that year. In 1841 the earlier signatures and plates of D'Orbigny's Mollusques de Cuba ap-

* The numbers of the figures of this species are exchanged on the plate with those of *H. Mauriniana.* This has caused some confusion in the work of Pfeiffer and Binney as regards synonymy. The text of this part of D'Orbigny's work was published in 1841.

peared, forming part of Ramon de la Sagra's Historia de Cuba. The whole work was not finished until 1853, but the earlier parts appeared at intervals. In this D'Orbigny described *Helix Lavalleana* and *H. Mauriniana*, but by an accident the numbers of the figures were transposed on the plate. Later Pfeiffer identified his *Helix saxicola* with *H. Lavalleana* D'Orbigny, and his *H. Boothiana* with *H. Mauriniana*, though the confusion of the numbers of the figures renders a little study necessary to make this clear. Still later W. G. Binney identified his father's *H. minuscula* with *H. Lavalleana* as correctly understood. Now, two things which are equal to the same thing being equal to each other, it follows that *H. minuscula*, if the above identifications be correct, is the same as *H. saxicola* and synonymous with it, as *saxicola* appears to be the older name. Until the identifications are a little more clearly established it will probably be better to retain Dr. Binney's widely known and accepted name.

Albers states that *H. apex* Adams cannot be united with *minuscula*, being distinguished by its size and by fine spiral sculpture. A nearer relative of *H. apex* is *H. hypolepta* Shuttleworth (1854).

The diagnosis of *Microphysa*, which, on the whole, seems poorly, if at all, distinguished from *Hyalina*, precludes the inclusion with it of such shells as *Conulus stearnsi* Bland and *Gastrodonta* (?) *Lansingi* Bland, as Mr. W. G. Binney has recently suggested. The more we learn about the characters of the soft parts, shell, and dentition of these land shells the more evident it becomes that many of these groups are unnecessary and might better be dispensed with. The series inosculate on every side.

Zonites (Conulus) chersinus Say.

Helix chersina Say (1821), Binney, l. c., p. 125 (as *fulvus*).

Habitat.—Alaska to Florida, Fort Churchill, Hudson Bay territory (Turner), to California and Texas. Typical, Fernandina, Hemphill; Archer, Alachua County, Dall; var. *egena*, Cedar Keys, Hemphill.

This species will probably be found identical with *Z. fulvus*, but as the name of *fulvus* is not incontested, and there seems to be some discrepancy in observations of the soft parts, I prefer to retain Say's name. The shells are larger and finer when from the north. The finest I have seen are from Arctic America. The name *Fabricii* of Beck and Möller is doubtless synonymous.

Zonites (Gastrodonta) suppressus Say.

Helix suppressus Say (1829), Binney, l. c., p. 130.

Habitat.—Michigan and New England to Florida, Binney; Fernandina, Hemphill.

Genus Succinea.

Of this genus, *S. campestris* Say is the most common and globose species of Florida. I have it from Key West, Palatka, and Fernandina.

S. aurea Lea is found at Fernandina, known by its narrow aperture and rich deep color. *S. obliqua* Say, or a form closely allied to it, was collected at Saint Augustine by Hemphill.

LIMNOPHILA.

Family PHYSIDÆ.

Physa heterostropha Say.

Physa heterostropha Say, 1817, Binney, L. and F. W. Sh. N. Am., ii, p. 84, 1865.

This universal species is so far the only one received by us from Florida, where it is widely distributed. This and *Planorbis trivolvis* are almost invariably found in the natural wells or sinks, but rarely any other species. The young ones are proportionally more elongated than the adults, but there is not much variation among Florida specimens, judged by those heretofore received. The Museum has it from Palatka, Enterprise, Johnson's Sink, Alachua County, the Sulphur and other springs at Tampa, and the marshes near Furguson's Pass, collected by Stearns, Hemphill, and Dall.

Family LIMNAEIDÆ.

Limnæa columella Say.

Limnæa columella Say (1818), Binney, l. c., p. 32.

This beautiful shell, distinguished by its delicately-sculptured surface, is widely distributed in Florida, and represented by several marked varieties. A delicate form resembling *L. casta* Lea, but narrower and almost exactly simulating a *Succinea*, was found in a ditch alongside the Florida Southern Railroad track at Gainesville, Fla. A stout, acutely-pointed, very calcareous form with a red tip, was collected by Mr. I. Greegor at the mouth of the Saint John's River. Another of similar form, but thin and delicate, also red-tipped, was obtained by Professor Wetherby at Pensacola. A smaller race, dark brown, with the spiral sculpture beautifully developed, was obtained by me at Palatka, on the banks of the Saint John's River, and in a brook at Enterprise, Lake Monroe.

Limnæa humilis Say.

Limnæa humilis Say (1822), Binn., l. c., p. 63.

Nearly typical specimens were obtained by Stearns near the saw-mill at Tampa. This is a more southern locality than it has yet been reported from.

Planorbis parvus Say.

Planorbis parvus Say (1817), Binney, l. c., p. 133.

Saint John's River at Palatka, Dall.

The figure of this species in the Land and Fresh-Water Shells of North America is poor; figure 224 is almost exactly like the same view of *P.*

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albus, while the shell itself is well distinguished. The front view, while accurate for some individuals, has the aperture much too flat, and not nearly as round as in most specimens of this species.

Planorbis dilatatus Gould.

Planorbis dilatatus Gld. (1841), Binney, l. c., p. 131.

Habitat.—New England to Maryland, Binney; Saint Augustine, Fla., Hemphill; ditch at Gainesville, and brook near Enterprise, Lake Monroe, Dall.

This seems to be the commoner small species in Florida. I have something almost exactly similar from Northern Mexico.

Planorbis trivolvis Say.

Planorbis trivolvis Say (1817), Binney, l. c., p. 115.

Not quoted by Binney from Florida. Poey's identification of a Cuban species with it is denied by Arango, who considers it as not belonging to the Cuban fauna. The Florida specimens are not large, but it seems widely spread, and is one of the species common to the sinks or natural wells of the interior. Palatka, Johnson's Sink, Alachua County, brook at Enterprise, Dall; marsh near Furguson's Pass, Hemphill. Abundant and variable.

Ameria scalaris Jay.

Paludina scalaris Jay, Cat Sh., 3d ed., p. 112, pl. 1, figs. 8, 9, 1839.
Physa scalaris Haldeman, Mon., p. 34, pl. iv, f. 9, 1842.
Ameria scalaris Dall, Ann. Lyc. Nat. Hist. N. Y., p. 356, 1870.

Habitat.—Tampa Bay, Anthony; Everglades, Florida, Jay; Lake Eustis, Florida, Wetherby; Saint John's River at Satsuma, brook at Enterprise, Lake Monroe, Dall. Also in the marl of which the shell mounds are built.

This remarkable form, of which the largest number of relatives are found in the southern hemisphere, does not belong to the *Physidæ*, but to the *Limnæidæ*. The soft parts resemble those of *Planorbis*, according to Wetherby. It appears to be abundant at the proper season, which is, however, later than most visitors remain in Florida. It is common in the shell marl of the Indian mounds, and attains a considerable size (15^{mm}) and great solidity. Not all the species are carinated, and some of them much resemble a *Physa* in general outline, though wanting the polished surface of that genus.

Family ANCYLIDÆ.

Ancylus obscurus Haldeman.

Ancylus obscurus Hald., Mon., p. 9, pl. 1, f. 4, 1844.

Habitat.—Nolachucky River, Haldeman; ditch at Gainesville, Fla., brook at Enterprise, Lake Monroe, Dall; marsh near Furguson's Pass,

Florida, Hemphill; Jamaica, West Indies, Adams; Saint Thomas and Porto Rico, West Indies, Shuttleworth.

In concluding this notice of the *Limnophila* of Florida I would take this opportunity of stating that the *Limnæa Palmeri*, described by me from the mouth of the Yaqui River, Gulf of California (Am. Journ. Conch., vii, part 2, p. 135, 1871), proves to be a *Recluzia*, and should be called *R. Palmeri.*

AURICULACEA.

In attempting to identify and name the *Auriculacea* of the collection from Florida I was brought to a standstill by the condition of the nomenclature which has been far from correctly used for the American species. It was therefore necessary to attempt a revision of it, which it is to be hoped may pave the way for a definite and final arrangement. It is to be regretted that some of our naturalists have published, and continued to use, names which in the same work they stated to be inapplicable to the animals under consideration.

The suborder *Basommatophora* is divisable into four natural groups, characterized by the mode of life: *Limnophila*, including *Chilinidæ Physidæ*, *Limnaeidæ*, and *Ancylidæ*, (*Latia* being doubtful as yet); *Akteophila*, including *Auriculidæ* and *Otinidæ; Petrophila*, with *Siphonariidæ* and *Gadiniidæ;* and *Thalassophila* with *Amphibolidæ*. The value of these groups will be differently estimated, but I cannot see my way clear to giving them, or any of them, the subordinal value assigned to part of them (under other names) by my friend Dr. Paul Fischer in his admirable manual now publishing. Most of these names have been used in diverse senses by various authors, but in regard to these denominations applied to larger groups, which vary with the opinions of authors, it seems to me impracticable to enforce the law of priority except for groups wholly identical. As for families it would seem best always to name them after their most characteristic genus.

The *Akteophila* of the United States comprise the following species as far as yet known:

Family AURICULIDÆ.

Shell spiral, with reversed nucleus, with a twisted or plaited columella; usually with parietal or labial teeth or liræ; texture, calcareous or horny; inoperculated, furnished with an epidermis. Tentacles contractile; eyes sessile at their inner bases; oviparous, phytophagous; dermis rugose; living in moist earth (*Carychium*, *Pythia*) or near the margin of rivers and the sea; never in water, though often where they are daily moistened by the tide. Dentition in little curved, numerous transverse series—rhachidian, $\frac{1}{1-3}$; laterals, $\frac{x}{1-3}$; uncini, $\frac{x}{1-3}$.

Subfamily AURICULINÆ.

Foot not divided transversely.

Genus CARYCHIUM Müller.

Shell cylindro-conical, minute, one denticle and the usual plait on the columella; lip thickened, reflected, sometimes with one or two obtuse denticles; nucleus hemispherical, immersed; internal septa of the spire persistent or but slightly absorbed; tentacles short, obtuse; the eyes sessile at their inner bases; foot entire obtuse behind; muzzle bilobed, extending in advance of the foot. Type *C. minimum* Müller, of Europe.* (Zool. Dan. Prodr., p. 242, 1776.)

Genus AURICULA Lamarck.

Shell large, strong, with thick epidermis; aperture with a large parietal plication behind that belonging to the columella; a strong parietal callus; the outer lip and peristome thickened but not dentate or lirate; internal septa partly absorbed. Animal blind, with rather long tentacles swelled at the distal end; foot entire, simple. Type *Auricula auris-midæ* Lamarck (Prodr., p. 71, 1799).

Subgenus AURICULASTRUM Fischer.

Shell smaller, thinner, and smoother; animal with eyes; tentacles rather short, subconic; foot simple.

Type *A. subula* Quoy. (Fischer. Man., p. 498, 1883.)

Auriculastrum pellucens Menke. Plate 18, fig. 8.

?*Auricula Dominicensis* Fér., Tabl., p. 103, 1822.

Auricula pellucens Menke, Syn. Meth. Moll., p. 131, 1830; Bland, Ann. Lyc. Nat. Hist. N. Y., xi, p. 87, 1874. Not of Reeve.

?*Auricula ceylonica* Reeve, Conch. icon. *Auricula*, No. 5, pl. 2 (as of A. Adams, P. Z. S., 1854, p. 10).

Not *Auricula pallescens* Reeve, l. c., as of Petit, P. Z. S., 1854, p. 10.

Habitat.—Demerara, Menke; Guadalupe Island, West Indies, Beau; Cedar Keys, Fla, Calkins; Punta Rasa, Prime; Oyster Bay, Hemphill.

There seems to be some confusion in Reeve, which I have not the books and specimens to unravel. There is no likelihood of the Ceylon

* *Carychium exiguum* Say, the common form of the United States, has not yet been reported from Florida, but doubtless will be found there. The nucleus of this species is so little advanced toward a whorl when the regular spire begins that it at first seems as if this genus formed an exception to the family rule of having a sinistral nucleus. It is, however, only superficially so. In *C. minimum* the immersion is often very recognizable, and some specimens of our species show it better than others. The teeth in *C. exiguum* are often deficient, but the columellar plait always exists, though perhaps not visible without breaking the shell. In L. and F. W. Shells of N. Am., ii, p. 7, Mr. Binney has taken the bilobed prolongations of the muzzle for an anterior division of the foot. Fig. 7 on the same page is very poor, and even inaccurate. See Plate 18, fig. 14, this volume.

shell being transported to the West Indies, and the two may probably prove distinct with better material. The animal has an entire foot with short tentacles, well developed eyes, and rather short muzzle. It was found living by Hemphill and Calkins. In adolescent shells, it is clearly seen that the anterior fold is continuous with the inner, and the posterior fold with the outer edge of the columella, which edges are strongly twisted and respectively continuous with the peristome, the space between them being broadly excavated.

It is probable that this is identical with the species referred to as *A. Dominicensis* by Férussac from Santo Domingo. As that species was not described in such a way as to be identifiable, it is probably better to retain the well-known name of Menke.

Genus TRALIA Gray.

Trälia Gray, Turt. Man. Brit. Sh., 2d ed., p. 21, 1840; P. Z. S., 1847, p. 179; Pfr. Zeitschr. für Mal., 1853, p. 7.

Tralia, sp., H. & A. Adams, P. Z. S., 1854, pp. 11–12; Gen. Rec. Moll., ii, p. 244, 1855; W. G. Binney, l. c., ii, p. 16, 1865.

Voluta, sp., Gmelin, Donovan, Turton.

Bulimus, sp., Brugière.

Auricula, sp., Férussac, Lamarck, D'Orbigny.

Melampus, sp., Pfr. Mon. Aur. Viv. 1856, p. 46.

Shell elongated, with a plait on the column and two on the body whorl; out lip thickened, not lirate; foot entire, elongated, simple behind.

Several sections which were established by H. A. Adams, under this genus (*Pira*, *Signia*, *Persa*), according to Dr. Paul Fischer, should be united with *Melampus*. Neither that author nor Mr. Tryon seem to have noticed that *Tifata* H. & A. Adams and *Detracia* Gray were founded on the same type. I have seen no reference to observations by any one in this country on the living animal of the type of *Tralia*, which is apparently not rare in Southern Florida.

It is not known to what animal the figure of *Tralia* given by Binney in the Land and Fresh Water-Shells of North America (part 2, p. 16) belongs. It is said to be drawn by Stimpson from a species found in Charleston Harbor, and may represent *Alexia denticulata*, especially as the genuine *Tralia pusilla* is not yet known from so far north.

Subgenus TRALIA s. s.

Peristome thickened, slightly reflected; anterior parietal lamina largest; outer lip sinuous, concavely impressed at the middle with a single strong ridge longitudinally revolving into the depths of the aperture. Type *Voluta pusilla* Gmelin.

Tralia pusilla Gmelin. Plate 18, fig. 5.

Voluta pusilla Gmelin, Syst. Nat., p. 3436, 1789, fide Pfeiffer; Dillwyn, Rec. Sh., 1, p. 507, 1817.

Voluta triplicata Donovan, British Shells, pl. 138, 1802.

Bulimus ovulus Brugière, Ency. Meth., 1, p. 339, 1789.
Auricula nitens Lamarck, An. s. Vert., vi, pt. 2, p. 141, 1822.
Auricula ovula Férussac, Prodr., p. 104, 1821.
Auricula ovula D'Orbigny, Moll. Cuba, 1, p. 186, pl. xiii, figs. 1–3 (excl. leg. tab.).
Tralia pusilla Gray, Turt. Man., ed. ii, p. 21, 1840.
Auricula leucodonta Nuttall, MSS. teste Pfeiffer.
Melampus pusillus Pfr., Mon. Aur. Viv., p. 46, 1856.
Tralia pusilla H. & A. Ad., Gen. Rec. Moll., ii, p. 244, pl. 82, fig. 8, 1855; W. G. Binney, l. c., ii, p. 17, 1865.

Habitat.—Cuba, Martinique, Santa Lucia, D'Orbigny; Cuba, Jamaica, Guadalupe, and Porto Rico, Arango; Bermuda, C. B. Adams; Florida, Binney and Stearns; Sandwich Islands, Pfeiffer (?).

This species is easily recognized by its pure brown color, three plaits, and the single ridge on the inside of the impressed outer lip.

The names of Gmelin and Brugière appeared in the same year. Most naturalists have followed the former. The much more characteristic name of Donovan we are unfortunately obliged to reject as a synonym.

Auricula panamensis of C. B. Adams belongs to the restricted subgenus. It is smaller, more compressed, darker colored, and with a more sinuous outer lip than the Antillean shell, but is otherwise extremely similar.

Subgenus ALEXIA Gray.

Auricula Draparnaud, Tabl., p. 53, 1801; Gould, Inv. Mass., p. 199, 1841.
Alexia Gray (as of Leach MSS.), P. Z. S., 1847, p. 179.
Ovatella Gray, Turt. Man., 2d ed., pp. 15, 225, 1840; P. Z. S., 1847, p. 179, *olim;* Moquin Tandon, Moll. Fr., ii, p. 415, 1855. Not *Ovatella* Bivona, 1832.
Conovulus Gray, Turt. Man., 3d ed., p. 192, 1857.
Carychium Blainville, Mal., p. 453, 1825; Michaud, Compl. Drap., p. 73, 1832; *ex parte.*
Melampus, sp., Jeffreys, Brit. Conch., v, p. 106, 1869.
Voluta, sp., Montague, Turton, Berkeley.
Actæon, sp., Fleming.
Jaminia, sp., Brown.
Pythia, sp., Gray, 1821; Beck, 1839 (=*Phitia* Blainville as of Gray).
Monica H. & A. Adams, Gen. Rec. Moll., ii, p. 247, 1855.

Shell elevated; outer lip thickened by a ridge of callus within the edge; callus simple or denticulated; no liræ or longitudinal ridges; other characters as in *Tralia.* Type *Voluta denticulata* Montague.

Tralia (Alexia) myosotis Draparnaud.

Auricula myosotis Drap., Tabl., p. 53, 1801; Hist., p. 56, 1805; Jeffreys, Lin. Trans., xvi, p. 368.
Voluta denticulata Montague, Test. Brit., p. 234, pl. 20, fig. 5, 1802; Turton, Conch. Dict., p. 234, 1819.
Actæon denticulatus Fleming, Brit. An., p. 337, 1828.
Jaminia denticulata Brown, Conch. Gt. Brit., 1st ed., pl. 51, fig. 6, 1827; 2d ed., p. 22, pl. viii, f. 6, 1844.
Jaminia quinquedens Brown, 1st ed., l. c., pl. 51, fig. 11; 2d ed., p. 22, pl. viii, fig. 11, 1844.

Auricula (Carychium) myosotis Blainville, Mal., p. 453, 1825.
Carychium myosotis Michaud, Compl. Drap., p. 73, pl. 3, figs. 16, 17, 1832.
Pythia denticulata Beck, Index Moll., p. 103, 1838.
Voluta reflexa Turton, Conch. Dict., p. 250, 1819.
Carychium (Phytia) myosotis Moquin Tandon, Moll. Fr., ii, p. 417, pl. 29, fig. 33, 1855.
Carychium (Ovatella) denticulata Moquin Tandon, l. c., p. 415, pl. 29, figs. 27–29, 1855.
Conovulus (Ovatella) denticulatus Gray, Turton's Man., 2d ed., p. 225, fig. 144, 1840; 3d ed., p. 192, fig. 46, pl. 12, fig. 144, 1857.
Conovulus denticulatus var. *myosotis* Forbes and Hanley, Brit. Moll., iv, p. 194, pl. cxxv, figs. 4, 5.
Melampus myosotis Jeffreys, Brit. Conch., v, p. 106, pl. 98, fig. 2, 1869.
? *Melampus denticulatus* Stimpson Sh. of N. Eng., p. 52, 1851 (partly ?).

Variety **ringens** Turton.

Voluta ringens Turton, Conch. Dict., p. 250, 1819.
Carychium personatum, Michaud, Compl. Drap., p. 73, pl. 15, figs. 42, 43, 1832.
Auricula tenella Menke, Syn., p. 131, 1830.

Forma junior.

Auricula ciliata Morelet, Moll. Portug., p. 77, pl. 7, fig. 4, 1845.
Alexia setifer Cooper, Proc. Acad. Nat. Sci. Phil., 1872, p. 143, pl. 3, figs. A1–A6.

Habitat.—Britain; European Seas; Mediterranean; Madeira; Jeffreys. Jamaica, West Indies (introduced), Barrett; east coast of the United States, probably; not yet clearly determined as distinguished from *Leuconia bidentata.* San Francisco Bay, California (introduced), Cooper.

The synonymy of this species might have been much enlarged, but to no particular purpose. Both the animal and its shell of *A. setifer* agree with British examples and not with the form described by Gould, which is a *Leuconia.* It is probable that when search is made, with the distinctions kept in view, this species will be found on the eastern coast of the United States wherever *Leuconia* exists, both being doubtless introduced species. I have not heard of either south from New York.

Subfamily MELAMPINÆ.

Foot transversely divided by a sulcus, generally at about the anterior third.

Genus PEDIPES Adanson.

Pedipes Adanson, Sénégal, p. 11, t. 1, figs. G, S, N.
Pedipes B, Blainville, Man. Mal., 1, p. 452, 1825.
Polyodonta G. Fischer, Tabl. Syn., p. 127, 1808, *ex parte.*

Shell imperforate, solid, globular-conic, few whorled, the last whorl much the largest; columella broad, with two strong plications or revolving ridges; one strong parietal tooth, outer lip sharp with a callus within its borders usually denticulated or nodulus. Internal septa not absorbed. Foot short, simply rounded before and behind, divided by a deep sulcus; tentacles cylindrical, pointed. Type *P. afra* Gmelin.

This genus is ascribed to Adanson by courtesy, he being a non-binomial writer not entitled to be quoted in synonymy. It appears to have first been adopted by Blainville. It represents in this division of the family the *Marinula* of King, which belongs to the other subfamily. Fischer states that a section shows the axis to be hollowed throughout its length.

Pedipes liratus W. G. Binney. Plate 18, fig. 15.

Pedipes lirata W. G. Binney, Proc. Acad. Nat. Sci. Phil., 1860, p. 154; L. and F. W. Sh. N. Am., pt. ii, p. 20, fig. 21, 1865.

Habitat.—Cape Saint Lucas, Xantus; San Diego, Cal., Orcutt.

Pedipes unisulcatus Cooper. Plate 18, fig. 6.

Pedipes unisulcata Cooper, Proc. Cal. Acad. Sci., 1866, p. 294, p. 29.

Habitat.—San Pedro, Cal., Cooper; head of Gulf of California, near mouth of Yaqui River, Palmer.

Pedipes naticoides Stearns. Plate 18, fig. 17.

Pedipes naticoides Stearns, Proc. Bost. Soc. Nat. Hist., October, 1869, vol. xiii, p. 108.

Turbo mirabilis Muhlfeld, Mag. Ges. Fr. Nat. Berlin, viii, p. 8, t. 2, fig. 13 *a–b*, 1818; Pfr. Mon. Aur., p. 70 (*Pedipes*).

Pedipes quadridens Pfr., Wiegm. Arch., 1839, 1, p. 357.

Pedipes ovalis C. B. Ad., Contr., to Conch., p. 41, Oct., 1849.

Pedipes globulosus C. B. Adams (Mss.).

Pedipes tridens Pfr., P. Z. S., 1854, p. 122; Mon. Aur., p. 72.

Habitat (*naticoides*).—Tampa, Stearns; Key West, Hemphill; (*mirabilis*) Cuba, Pfeiffer and Gundlach; (*ovalis*) Jamaica, Bermudas, C. B. Adams; Guadalupe, Porto Rico, Arango.

Pfeiffer relegates his *P. quadridens* to *P. mirabilis* Muhlfeld. His *tridens* was shown by Gundlach to be a young stage of the same. *P. ovalis* was stated by its describer to differ from Pfeiffer's species in being slightly more elongated, with the sulcations less marked and the surface smoother. A comparison of specimens of Adams's species with others of *P. naticoides*, shows that these are here also the points of difference. Hence it seems likely that *P. naticoides* is a synonym of *P. quadridens* (= *mirabilis*). However, as the latter has not been figured, and I have not been able to see specimens of the Cuban form, I prefer to retain Stearns's name while indicating its probable synonymy. *P. liratus* W. G. Binney (1860), from Cape Saint Lucas, Lower California, collected by Xantus, and San Diego, Cal., C. R. Orcutt, is very similar, but differs slightly in color and arrangement of the teeth. *P. unisulcatus* Cooper, from California, is quite different and much larger.

Pedipes elongatus, n. s. Plate 18, fig. 4.

Shell shaped like *Alexia myosotis*, but more obtuse; color pale straw-color or waxen, with opaquer streaks in the direction of the axis; whorls four and a half beside the inverted nucleus, smooth, not inflated, appressed against the suture; apex blunt, out of which rises the arch of

about one-third of the nucleus; a chink in front of the columellar reflection, but no umbilicus; aperture rather long, rounded in front, pointed behind, outer lip sharp, hardly thickened; columella reflected with a solid white callus extended, though thinner behind, across the body whorl to the posterior angle of the aperture; columella with two teeth, the posterior large, its plane at right angles to the axis, its crest extended forward in a curve forming a raised inner edge to the column, inside of which is the smaller anterior tooth, its plane parallel with that of the larger one; body whorl with a large, flattened, twisted tooth at right angles to the surface on which it stands and with its direction following the curve of the whorl inward; lon. of shell, 4 ., of aperture, 2; max. diam. of shell, 2^{mm}.

Habitat.—Marco, Fla., in the moss on a dried-up brackish marsh. Collected by H. Hemphill.

This species at first looks like a young smooth *Alexia*, but is at once distinguished by its columella and apex. It is possible that in older specimens the outer lip may be thickened or dentate. In those received there is no indication of anything of the kind, but neither is there on the specimens of the *P. naticoides*, which we know has a thickening and little tubercle on the outer lip when fully adult. The epidermis is very thin and smooth; there is no trace of sculpture; the appression of the whorls at the sutures gives them in some lights a marginate aspect. It is more elongate than any described recent species.

Genus MELAMPUS Montfort.

Melampus Montfort, Conchyl., vol. ii, p. 318, 1810.
Conovulus Lamarck, Extr. d'un Cours, 1812, *olim;* Bowdich, El. Conch., pp. 28, 63, 1822.
Type *Melampus coniformis* Brugière, = *Voluta coffea* Linné, Syst. Nat., ed. xii, p. 1187, Barbados.

Subgenus MELAMPUS s. s.

Shell oval conoid, the spire shorter than the last whorl; whorls narrow, the aperture correspondingly sublinear, columella strongly plicate; parietal border with from one to five teeth or ridges; outer lip thin, sharp, simple, within lirate to a thickened border behind the peristome; anterior margin rounded; the aperture widest anteriorly. Foot truncate in front, bifid or indented behind; tentacles contractile, subcylindrical, annulately wrinkled; muzzle long, emarginate in front; eyes at the inner bases of the tentacula.

Melampus coffeus Linné. Plate 18, fig. 3.

Bulla coffea Linné, Syst. Nat., ed. x, p. 729, 1758.
Voluta minuta Gmelin, Syst. Nat., 3436, 1789, *ex parte.*
Bulimus coniformis Brugière, Encycl. Meth., 1, p. 339.
Conovulus coniformis Lamarck, An. s. Vert., 2d ed. viii, p. 391.
Melampus fusca Morch, Cat. Yoldi, p. 38, 1852, as of Martyn.
Auricula coniformis D'Orbigny, Moll. Cuba, 1, p. 187, pl. xiii, figs. 4–7, 1841.*
Melampus coffeus H. & A. Ads., Gen., ii, p. 243, pl. 82, figs, 7, 7*a*, 1855.

* The legend on the plate has the numbers transposed with those of *A. ovula*.

Floridian localities: Bird Key, Jewett; Tampa, Conrad; Punta Rassa, Hemphill; Cedar Keys (?) Hemphill. It is quoted from Florida by D'Orbigny, Arango, and Binney; Cuba and Martinique, D'Orbigny; Bahamas, Rawson; Jamaica, Porto Rico, Guadalupe, Texas, Mexico, and Cayenne, by Arango, also by him, erroneously, from Labrador!

The figure in the Genera of recent Mollusca, by A. Adams, whether from the position of the animal or otherwise, does not show any bifurcation of the posterior end of the foot.

The young and adolescent shells are with difficulty separated from those of *M. flavus* of authors. The double parietal lamina is the best character, and this is sometimes double in *M. flavus*. There is no constant criterion, and I should not be surprised if a larger number of specimens would lead to the opinion that they should bear but one specific name. This is not the *Auricula ovula* of D'Orbigny, as supposed by Binney, who was apparently misled by the error in the lettering of the plate.

This species is frequently marked by fine revolving striæ, especially on the spire, where one line is generally present and near the other extreme. The number of liræ varies; they are, however, usually more numerous and more evenly distributed than in *M. flavus*. A form somewhat more elongated, with more pointed spire and less regular and numerous liræ, and with the anterior parietal lamina more frequently obsolete or even absent, has been called *M. bermudensis*. The *M. Gundlachi* of Pfeiffer from Cardenas, Cuba, is considered distinct by Arango, but I have not seen any specimens of it.

Melampus floridanus Shuttleworth. Plate 18, fig. 2.

Melampus floridanus Pfeiffer, Mon. Aur. Viv., p. 36, 1856, as of Shuttleworth MSS.

Tralia floridiana H. & A. Adams, P. Z. S., 1854, p. 11, name only; W. G. Binney, l. c., p. 16, 1865.

Melampus floridanus Shuttleworth, Pfr. Mal. Blätt., 1854, p. 147. Name only.

Habitat.—Florida Keys, Binney; Clear Lake, Florida, Wetherby; near the town of Tampa, Fla., Stearns.

Nothing is known of the soft parts of this species which is placed here, because its conchological characters do not admit of its association with *Detracia bulloides*, as has been hitherto done by authors. The two sharp parietal laminæ remove it from that group, and it is therefore remanded to *Melampus* until the soft parts are known.

Melampus flavus Gmelin. Plate 18, fig. 1.

Voluta flava Gmelin, Syst. Nat., p. 3436, No. 5, 1789.

Bulimus monile Brugière, Encycl. Meth. 1, p. 338, 1789.

Conovulus flavus Anton, Verz. Conchyl., p. 48, No. 1768, 1839.

Auricula monile Lamarck, An. s. Vert., vi, pt. 2, p. 141, 1822.

Melampus coronatus C. B. Adams, Contr. Conch., p. 41, 1849, testa jun.

Melampus torosa Mörch, Cat. Yoldi, p. 38, 1852; as of Martyn.

Melampus flavus C. B. Adams, Contr. Conch., pp. 42, 186, 1849.

Melampus coronulus H. & A. Adams, P. Z. S., 1854, p. 10.

Melampus flavus W. G. Binney, l. c., 2d part, p. 12, 1865.

Habitat.—In Florida, Tampa, Stearns; Key West and Cedar Keys, Hemphill; Bahamas, Rawson; Saint Thomas, West Indies, C. B. Adams; Cuba, Guadalupe, Porto Rico, Arango; Panama (as *Melampus Tabogensis* Ad.), C. B. Adams; Jamaica (as *M. coronatus*), C. B. Adams.

This species is best distinguished from *M. coffeus* by its generally single parietal lamina, its more irregular and fewer liræ, and in the young state, when fresh, by the epidermis rising in little tufts along the strong median sulcation or revolving groove, which usually marks the middle of each whorl on the spire. This state constitutes the *M. coronatus* C. B. Adams. The dark brown West Indian specimens are very distinct, and, taken by themselves, seem perfectly so, but Floridian specimens vary and are seldom dark brown. They approximate much more nearly to *M. coffeus*, and appear, from the variations in color and shape, to hybridize with *M. lineatus* (*bidentatus*) Say. *M. Tabogensis* seems undistinguishable from some West Indian varieties. The white bands vary from three to six in number. The revolving grooves or striæ are more constant and more conspicuous than in *M. coffeus*, and the shell on the whole is smaller.

Melampus lineatus Say. Plate 18, figs. 9, 12.

Melampus lineatus Beck, Ind. Moll., p. 107, 1838.
Melampus bidentatus var. *lineatus* Say, Journ. Acad. Nat. Sci. Phila., ii, p. 246, 1822.
Melampus bidentatus Say, l. c., p. 245, and most American authors. Not of Montague.
Auricula cornea Deshayes, Encyc. Méth., ii, p. 90, 1830.
Melampus corneus Stm., Sh. of N. Engl., p. 51, 1851.
Auricula biplicata Deshayes, l. c., p. 91, 1830.
Auricula jaumei Mittré, Revue Zool., 1841, p. 66.
Melampus borealis Pfeiffer. Not of Conrad.
Auricula bidentata Gould. Not of European authors.

Habitat.—Coast of the United States from New England to Texas; Saint Augustine, Cedar Keys, Tampa Bay, in Florida, Hemphill; Saint Thomas, West Indies, C. B. Adams, in Nat. Mus. coll.; Tortola, Kjaer. On salt marshes and generally near the sea.

This is a very distinct species in the north; the southern specimens frequently vary toward *M. flavus*, and perhaps hybridize, as they are found in the same localities.

The name by which this species is usually known to American authors is generally admitted to be objectionable by those who have looked into the synonymy. It has been retained rather because the name of *corneus* was considerably later and out of courtesy to the father of American conchology. It does not seem to have been noticed that Say's other name, which was applied to the northern variety and is of equal date, could advantageously be used.

The species is generally but not always provided with one parietal and one columella tooth. There are sometimes two parietal teeth. Say describes the southern form (his *bidentatus*) as having the posterior end

of the foot bifid. The northern form (his *lineatus*) is stated by Binney to have it obtusely pointed. There is here a discrepancy worthy of investigation. If the bifurcation of the foot is a merely individual variation or due to the influence of certain localities or temperatures on the specimens subjected to them and found in them only, it ought to be known.

The following species of *Melampus* are in the collection of the National Museum from the western coast of America, and seem to be distinct from each other and from the foregoing eastern species:

Melampus Bridgesi Carpenter, Panama.
Melampus trilineatus C. B. Adams, Panama.
Melampus olivaceus Cpr., San Pedro, Cal., to San Diego, and at Mazatlan. Plate 18, fig. 16.

This looks toward *M. lineatus* Say on the one hand, and toward *M. coffeus* on the other. It is, however, fairly well distinguished from either. There are sometimes four parietal folds beside that on the columella.

Subgenus LEUCONIA Gray.

Leuconia * Gray, Turton Man., 2d ed., p. 227, 1840, (no descr.); P. Z. S., 1847, p. 179; Turton Man., 3d ed., p. 195, 1857.
Voluta, sp., Montague, 1803. *Pedipes*, sp., Clark.
Jaminia, sp., Brown; not Risso, 1827.
Ovatella, sp., Bivona, Nuove gen., pp. 9, 22, 1832.
Auricula, sp., Férussac, tab. Moll., p. 103; Gray, Jeffreys, &c.
Actæon and *Volvaria*, sp., Fleming, Brit. Anim., pp. 333, 337.
Melampus, sp., Jeffreys, Brit. Conch., v, p. 104, 1869.
Alexia, sp., Binney, L. and F. W. Shells of N. Am., pt. ii, p. 4, 1865.

Shell small, ovate; spire produced, pointed; smooth, with a thin epidermis; columella twisted with one or two parietal plates, the anterior much the stronger, outer lip thickened, sometimes with one denticle on the callus; foot subtruncate or rounded behind, transversely divided at about the anterior third below. Type *Voluta bidentata* Montague.

Melampus (Leuconia) bidentatus Montague. Plate 18, fig. 13.

Voluta bidentata Montague, Suppl. Test. Br., p. 100, pl. 30, f. 2, 1803.
Auricula micheli Mittré, Rev. Zool., 1841, p. 66.
Auricula dubia Cantraine, Bull. Brux., ii, p. 383.
Ovatella bidentata Bivona, Nuove Gen., p. 22, 1832.
Auricula erosa Jeffreys, Linn. Trans., vol. xvi, p. 269.
Melampus borealis Conrad, Am. Journ. Sci., 2d series, xxiii, p. 345, 1833.
Auricula denticulata Gould, Invert. Mass., p. 199, fig. 129, 1841. Not of Montague.
Alexia myosotis Binney, L. and F. W. Shells N. Am., part ii, p. 4, 1865. Not of Draparnaud.
Auricula Sayii Kuster in Chemnitz, Conch. Cab., ed. 2, p. 49, pl. vi, figs. 14, 15.
Leuconia Sayii A. Adams, P. Z. S., 1854, p. 36, No. 2; Pfr. Mon. *Auriculacea*, p. 157.
? *Auricula Bivonæ* Philippi, Moll. Siciliæ, ii, p. 118, 1844.
Melampus bidentatus Jeffreys, Brit. Conch., v, p. 104, 1869. Not of Say.

*A genus *Leuconia* has been erected among sponges, I believe, by Hæckel. I would suggest for it the modified form *Leuconella*.

Habitat.—Western shores of British Islands from Shetland to Sark, and southward to Madeira, the Mediterranean and Adriatic Seas. Introduced on the coast of New England, North America.

This species differs from *Melampus* only in the form of the shell, which is more elongate, and in the absence of liræ on the outer lip. The posterior part of the foot shows a slight tendency to indentation, but not less than some species of *Melampus*, as it appears this character is somewhat variable. . The shell, except in its smoother epidermis and obsolete posterior parietal denticle, is almost exactly like the lighter colored forms of *Alexia myosotis*, a fact which has led to much confusion. There is often a single projecting point on the thickened outer lip, more frequently in American than in European specimens. The posterior denticle, too, is more frequently developed in American examples. Mr. Binney, while recognizing that the description of the animal by Dr. Gould did not agree with that of the genus *Alexia*, nevertheless referred the species to *Alexia myosotis*.

I have very little doubt that Kuster's description was intended for this shell; his figure does not agree with his text, but, nevertheless, might have been badly drawn from a short stout specimen of this species.

It is probable that the true *Alexia myosotis* is found on the coast of New England with this shell and that they have been confounded with each other. This can only be determined by an examination of the living animal, but some specimens of the shells I have seen exactly agree with the *Alexia*. Both of them have probably been introduced on ballast or otherwise from Europe. It is very probable from Draparnaud's text that he may have confounded the shells of the two forms, but he carefully describes the animal of his *Auricula myosotis*, and this description says nothing of the division of the foot, which he certainly would have noticed had he examined living specimens of *Leuconia*. The dentate form (var. *ringens* Turton and Jeffreys) was not known to him and was described by Michaud, in his supplement to Draparnaud's work, issued in 1839, as *Carychium personatum*.

The name to be adopted for the group we have termed *Leuconia* is still somewhat doubtful. I have been unable to examine Bivona's pamphlet in which the genus *Ovatella* is described. The only references to it which convey much information are those of Philippi and Gray. In Turton's Manual Dr. Gray refers to *Ovatella* as the equivalent of *Alexia* as late as 1857, perhaps following Moquin Tandon, but ten years before he had referred to "*Ovatilla* Bivon" as in part equivalent to *Leuconia*, and to *Alexia* as equal to "*Ovatella* Gray, 1840, not Bivon" (P. Z. S., 1847, p. 179). Philippi quotes Bivona for *Ovatella bidentata* Bivona non Montague (= *O. Bivonæ* Phil.), which is Bivona's third species, his first being *O. polita* (= *Auricula* (*Melampus*) *conoidea* Fér. fide Philippi), his second being *O. punctata* Bivona (= *Auricula Firminii* Payr. fide Philippi, = *Monica* H. & A. Adams), while another of Bivona's species is

supposed to be an *Odostomia*. Under the circumstances it would seem probable that Bivona's genus was a heterogeneous assembly, and that he did not name any type, and that it were better to defer its adoption or rejection until its scope can be definitely ascertained. If his first species be taken as type *Ovatella* would be synonymous with *Melampus*. There are two species of *Leuconia* described by Pfeiffer from Cuba, of which the collection contains no specimens.

Subgenus DETRACIA Gray.

Detracia Gray, Turton's Man., ed. 2, p. 20, 1840.
Tifata H. & A. Adams, Gen. Rec. Moll., ii, p. 245, Sept., 1855.
Tornatella, sp., Férussac. *Tralia*, sp., Binney after Adams.

Shell elongated, solid, rounded to a point at both ends; parietal region with a thin callus but no teeth or liræ; one strong plait on the columella; aperture very narrow; outer lip lirate within, simple and acute at the margin. Type *Voluta bullaöides* Montague.

Melampus (Detracia) bulloides Montague (em.). Plate 18, fig. 7.

Voluta bullaöides Montague, Test. Brit., p. 339, pl. 30, f. 4, 1803.
Auricula multivolvis Jeffreys, cf. Brit. Conch., v, p. 109, 1869.
Auricula cingulata Pfr., Wiegm. Arch., 1, p. 251, 1840.
Auricula oliva D'Orbigny, Moll. Cuba, i, p. 189, pl. xiii, figs. 8–10, 1841.
Melampus bulla Lowe, Beck Ind. Moll., p. 108, 1838.
Auricula stenostoma Kuster, 2d ed., Chemn. Conch. Cab., p. 40, pl. 6, figs. 4–6 (olim in index).
Melampus cingulatus Pfr., Mon. Aur. Viv., p. 18, W. G. Binn., Terr. Moll. U. S., vol. iv, p. 161, pl. lxxv, figs. 12, 13, 1859.
Tralia cingulata W. G. Binney, L. and F. W. Sh. N. Am., ii, p. 18, 1865.
Melampus variabilis Gassies, fide Rve. Conch. Icon. Aur., pl. vi, f. 46.
Melampus Poeyi Pfr., Zeitschr. für. Mal., p. 126, 1853; Mon. Aur. Viv., p. 17, fide Arango, Moll. Cubana, p. 58.
Detracia bullaöides Gray, Turt. Man. Brit. Sh., p. 20, 1840; P. Z. S., 1847, p. 179.
Detracia cingulata Fischer, Man., p. 501, 1883.
Tifata cingulata H. & A. Adams, Gen. Rec. Moll., ii, p. 245, 1855.

Habitat.—Florida, Bartlett; Cedar Keys, Stearns; Key West, Hemphill, Captain Pickering; West Indies, various authors; Cuba, Arango; New Caledonia, Reeve (?).

I cannot discover any printed description of the soft parts of this species. It is put with the *Tralias*, which have the foot not transversely divided and not bifid behind, by the brothers Adams, and with *Melampus*, which has the opposite characters, by Fischer. As the latest authority, I follow the latter; but the facts should be determined by some one on the ground from the living animal, as alcoholic specimens are often so contracted as to be difficult to properly interpret. The nucleus is inverted; the microscopic revolving lines are often wanting over the greater part of the whorl.

Montague and Jeffreys described exotic specimens under the erroneous idea that they were British. It is believed to be confined to the Antillean region.

Subgenus SAYELLA Dall.

Shell small, thin, subfusiform; spire elevated, last whorl contracted; nucleus immersed; columella continuous with the anterior margin of the aperture, and twisted to form one strong spiral ridge entering the volutions; no parietal teeth or callus; outer lip thin, sharp, without internal liræ, thickening, or denticulations. Soft parts unknown. Type *Leuconia Hemphillii* Dall.

This section is distinguished by its characters from any other of either group of the family. It seems nearest *Blauneria* by the characters of the shell, but indicates a medium between that group and *Detracia*. It is named in honor of Thomas Say, the father of American malacology. The confused state of the manuals of American land shells on the subject of the *Auriculidæ* is my excuse for placing it in a group where by subsequent investigation I find it cannot remain.

Sayella Hemphillii Dall. Plate 18, fig, 11.

Leuconia Hemphillii Dall, Proc. U. S. Nat. Mus., 1883, p. 323, plate x, fig. 6, Dec. 1883.

Habitat.—Cedar Keys, Fla., on mudflats, Hemphill.

Sayella Crosseana, n. s. Plate 18, fig. 10.

Shell minute, slender, ivory white, with longitudinal subtranslucent pencillings and a suffusion of dark brown on the columella, fading away toward the periphery of the base; whorls five and a half beside the immersed nucleus, which is glassy; surface polished, faint striæ of growth evident; whorls flattened, the last about half the length of the shell, the aperture slightly contracted, or rather the coil of that part more compact than the antecedent whorl; suture very distinct, with the whorl behind it a little swelled and the whorl before it smoothly appressed; apical turns a little inflated; apex blunt, with the immersed nucleus half buried in it; aperture simple, smooth, not very sharp edged, the margin rounded into the twisted, thickened edge of the columella; base radiately striate imperforate. Lon. 2.5^{mm}; lat. 1.0^{mm}; aperture slightly oblique, 0.75^{mm}.

Habitat.—Florida, Col. E. Jewett, one specimen. This remarkable little shell is about one-fourth the size of *Cionella acicula* Binney, which name had been attached to it. Its relations are evident, the nucleus and the twisted columella, the diminished last whorl, general form and even the columellar coloration all repeat in miniature the characteristic features of *Sayella Hemphillii*. It may be thought absurd to put such a shell into a subgenus of *Melampus*, and it is possible that the subgenus proposed may eventually take higher rank, but in the absence of any knowledge of the soft parts, and of important characters in the shell, it seems better to take a conservative course. From *Ferussacia*, *Acicula* and *Geostilbia* and their allies this little shell is distinguished by its sinistral nucleus which places it in a widely different group. From *Blauneria* its dextral shell and conchological features appear to sufficiently distinguish it. It is named in honor of the distinguished French

conchologist and naturalist, M. Hippolyte Crosse, of Paris, whose labors have ameliorated every department of malacology.

The exact locality of this shell is not known, but it is probable that Colonel Jewett collected it with other minute shells on one of the Keys. It was presented by him to Dr. R. E. C. Stearns, and acquired by the U. S. National Museum with the Stearns collection.

Genus BLAUNERIA Shuttleworth.

Blauneria Shuttleworth, Berner Mitth. Diagn. Neue. Moll, p. 148, 1854.

Foot simple, pointed behind, transversely sulcated (?); tentacles short, cylindrical, eyes behind and above their bases; shell ovate elongate, sinistral, thin, aperture long, narrow; peristome slightly thickened, outer lip slightly incurved in the middle, continuous with the twisted subtruncate columella; one strong, parietal fold, with a thin callus on the body whorl; last whorl the largest, suture indistinct, appressed. Type *B. heteroclita* Montague.

The sulcation of the foot in the typical species does not seem to have been recorded, though it is known to exist in *B. gracilis* Pease, according to Dr. Paul Fischer.

Blauneria heteroclita Montague. Plate 17, fig. 6.

Voluta heteroclita Montague, Test. Brit. Suppl., p. 469, 1808; Laskey, Wern. Soc. Mem., 1, p. 398, pl. viii, fig. 12 (3 views), 1809.
Achatina? pellucida Pfr., Wiegm. Arch., 1, 1840, p. 252.
Tornatellina cubensis Pfr., Symb. ad Hist., ii, p. 130.
Blanneria pellucida Shuttleworth, l. c., 1854; Pfr. Mal. Blätt., i, p. 152, 1854; Mon. Aur., p. 153, Binney, L. and F. W. Sh. N. Am., ii, p. 21, f. 22, 1865.
Blauneria heteroclita Arango, Moll. Cubana, p. 60, 1878.
Odostomia? cubensis Poey, Mem., i, p. 394, fide Binney.

Habitat.—Cuba, Jamaica, Porto Rico, Arango; Tampa Bay, Florida, Jewett and Stearns; in damp moss of dried-up brackish swamp near Marco, Fla., Hemphill; introduced into England, Laskey.

I understand from Mr. Tryon that he suspects the Cuban shell to be different from the British and Floridian specimens, but all that I have seen seem to belong to one species, and the various figures seem to agree very well together.

PETROPHILA.

Family SIPHONARIIDÆ.

Siphonaria alternata Say.

Patella alternata Say, Journ. Acad. Nat. Sci. Phil., v, p. 215, Feb., 1826.
Siphonaria alternata Say, Am. Conch., pt. iv, pl. 38, 1832; Binney's ed., pp. 124, 192 pl. 38; Binney L. and F. W. Sh. of N. Am., ii, p. 153, fig. 254, 1865; Dall, Am. Journ. Conch. vi, p. 32, pl. iv, fig. 10, 1870.

Variety **brunnea** Hanley.

Siphonaria brunnea Hanley, P. Z. S., 1858, pp. 24, 151.

Habitat.—Florida, Sarasota Bay and Islands., Hemphill and others; Bermuda (typical), C. B. Adams; Bermuda (variety) Rawson, in Stearns's collection.

This species does not seem to be common. The finest I have seen are from Bermuda. The variety shows more brown inside, but otherwise agrees with the type. Binney's figure is extremely bad.

Siphonaria lineolata D'Orbigny.

Siphonaria lineolata D'Orbigny, Moll. Cuba, i, p. 232, pl. xvii, figs. 13-15, 1842.
Siphonaria brasiliana Reeve, Mon. Siph.. pl. iv, fig. 17, Mar., 1856.
Siphonaria naufragum Stearns, Proc. Bost. Soc. Nat. Hist., xv, p. 23, Jan., 1872.
Patella leucopleura Arango (*exparte?*), Moll. Cubana, p. 230, 1880.

Habitat.—Amelia Island, East Florida, Stearns; Cuba, D'Orbigny; Rio, Reeve; Saint Augustine, Fla., Hemphill. It is unfortunately too certain that this fine species first described from North America by my friend Dr. Stearns is identical with that described and figured from Cuba by D'Orbigny. Specimens marked *Braziliana* Reeve, by Mr. Cuming, in the National Museum collection, do not appear to differ specifically, and another form from the Cape Verde Islands also runs very close to this one. Why Arango should have referred this species to *Patella leucopleura* is not clear; probably he had not examined authentic specimens.

Siphonaria picta D'Orbigny.

S. picta D'Orbigny, Voy. dans l'Am. Méridionale, Moll., 1839; Moll. Cuba, 1, p. 231, 1842.

This species, reported from Rio and from Cuba by D'Orbigny, has not yet been reported from Florida, but will doubtless eventually be found on the southern Keys.

Siphonaria ferruginea Reeve.

Siphonaria ferruginea Reeve, Mon. Siphon., pl. v, fig. 26, 1856.

No habitat was given by Reeve for this species, but a specimen which seems to belong to it was received from Strebel by the U. S. National Museum, in 1866, as collected at Vera Cruz, Mexico. It doubtless will be found to occur elsewhere on the American coast.

Family GADINIIDÆ.

Gadinia carinata Dall.

Gadinia carinata Dall, Am. Journ. Conch., vi, p. 18, pl. iv, figs. 12, 13, 1870.

Habitat—Aspinwall, Dr. Palmer; Barbados, U. S. Nat. Mus.; Cuba, Casey.

We may reasonably expect to find this rare and only Antillean species of the genus on the Florida Keys. At all events it should be carefully looked for.

Family ONCIDIIDÆ.

Onchidium floridanum n. s.

To Mr. Hemphill is due the credit of adding this genus to the fauna of eastern North America. The specimens arrived as this paper is

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going through the press and a detailed description must be deferred. The following notes, however, will indicate its external characters:

When living, the creature is of a uniform slaty blue, the under parts bluish white, with a greenish tinge to the veil. The surface appears beautifully smooth and velvety without dorsal tubercles; just within the slaty margin of the mantle is a single row of about (in all) one hundred whitish elongated tubercles. When crawling, it is of an oval shape about an inch long, and two tentacles extend forward beyond the mantle margin, resembling the oculiferous ones of *Vaginulus floridanus*. In spirits the surface is still smooth, but numerous circular hardly-elevated domelets cover the back, each appearing to contain one of the dorsal eyes described by Semper. The tentacles are entirely retracted; a narrow veil, with lightly escalloped edge, precedes the head; the muzzle is not prominent, is indented in the middle and puckered at the edges. The foot is about one-third wider than the mantle at each side of it. There is no jaw. The penis resembles that of *Siphonaria* in form and position. The animal exudes very little mucus. It was found on rocks between tides associated with *Chiton piceus*. Fifteen specimens were found at Knight's Key by Hemphill.

Onchidium indolens of Couthouy (Rio) and *O. armadillo* of Morch differ from the above in coloring. The latter, described from St. Thomas, has a very different dorsal surface. No others are known from East America. It would seem as if the small northern species, possessing a jaw like *O. boreale* Dall and *O. celticum* Cuvier, might appropriately be separated from the agnathous tropical forms as a subgenus, for which the name of *Onchidella* might be revived in a restricted sense.

Family CORBICULIDÆ.

Sphaerium contractum Prime.

Sphaerium contractum Prime, Am. Corbicul., p. 48, fig. 46, 1865.

Habitat.—Brook near Enterprise, Lake Monroe, Florida, Dall; Alabama, Showalter.

Pisidium abditum Haldeman.

Pisidium abditum Haldeman, Proc. Acad. Nat. Sci. Phil., i, p. 53, 1841; Prime, l. c., p. 68, fig. 72.

Habitat—In Florida, Pensacola, Hemphill; river near Palatka, Dall; spring near Tampa, Stearns; North America in general, from New England to Honduras, New Jersey to California, Prime.

This species seemed abundant, and was the only one of the genus observed by me in Florida.

WASHINGTON, *July* 1, 1885.

A LIST OF THE MESOZOIC AND CENOZOIC TYPES IN THE COLLECTIONS OF THE U. S. NATIONAL MUSEUM.

By JOHN BELKNAP MARCOU.

This list contains all the original types that I have been able to find in the collections of the National Museum. Many of the original labels have been lost or misplaced, and reidentification has frequently been necessary. This work has often been attended with some difficulty, owing to unsatisfactory descriptions and inaccurate figures. Many of the types which should be here have disappeared, sometimes altogether, but sometimes only one or more of the type specimens have been lost and the remainder found. All the specimens mentioned in this list have been carefully compared with the descriptions and figures referred to, they have been accurately and safely labeled, and can be seen at the National Museum. It is very probable that a few more of these type specimens may be found during the arrangement of the remainder of the collections, but only very few can be found in this way, as all the drawers have been searched especially for them. A small piece of green glazed paper has been pasted on every figured side of a specimen, and the Museum number, corresponding to a copy of the label in the Museum register, has been painted on every specimen; when the fossils are too small to admit of this, they have been inclosed in a glass tube and the number painted on it. The label contains the formation and locality, in addition to the information given in this list. I have not attempted to give the different horizons at which the fossils occur, as these are often very uncertain, except in a few instances in the Cretaceous, where they have been given according to Messrs. Meek, White, and Whitfield. I am under obligations to Dr. C. A. White, without whose knowledge of the collections it would have been impossible for me to identify many of the types recorded here.

LIST OF THE WORKS REFERRED TO.

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11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr. = Eleventh Annual Report of the United States Geological and Geographical Survey of the Territories, Washington, D. C.

Geol. Surv. California, Geology, Vol. I = Geological Survey of California, Geology, Volume I, Report of Progress and Synopsis of the Field-Work from 1860 to 1864, by J. D. Whitney, State geologist, Philadelphia, Pa.

Pal. Upper Missouri, <Smithsonian Cont. to Know. 172 = Palæontology of the Upper Missouri, Smithsonian Contributions to Knowledge No. 172, Washington, D. C.

Proc. Acad. Nat. Sci. Philad. = Proceedings of the Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.

Proc. U. S. Nat. Mus. = Proceedings of the United States National Museum, Washington, D. C.

Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean = Reports of Explorations and Surveys to Ascertain the Most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, Washington, D. C.

Rep. Expl. Great Basin of Utah, J. H. Simpson = Report of Explorations across the Great Basin of the Territory of Utah for a Direct Wagon-Route from Camp Floyd to Genoa, in Carson Valley, in 1859, by Capt. J. H. Simpson, Washington, D. C.

Rep. Geogr. & Geol. Expl. & Surv. West 100th Meridian = Report upon Geographical and Geological Explorations and Surveys West of the One Hundredth Meridian, in charge of First Lieut. George M. Wheeler, Washington, D. C.

Rep. Geol. Black Hills of Dakota = Report on the Geology and Resources of the Black Hills of Dakota, J. W. Powell in charge, Washington, D. C.

Rep. Geol. Eastern Uinta Mts., J. W. Powell = Report on the Geology of the Eastern Portion of the Uinta Mountains and a Region of Country Adjacent Thereto, by J. W. Powell, Washington, D. C.

Rep. Geol. Expl. 40th Parallel = Report of the Geological Exploration of the Fortieth Parallel, by Clarence King, U. S. geologist, Washington, D. C.

Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, Vol. IX = Report of the United States Geological Survey of the Territories, F. V. Hayden, U. S. geologist in charge, 4to series, Washington, D. C.

Rev. Foss. Ostreidæ N. A. = A Review of the Fossil Ostreidæ of North America, and a Comparison of the Fossil with the Living Forms, by Charles A. White, in Fourth Annual Report of the Director of the United States Geological Survey, Washington, D. C.

Rev. Non-Marine Foss. Moll = A Review of the Non-Marine Fossil Mollusca of North America, by Charles A. White, in Third Annual Report of the Director of the U. S. Geological Survey, Washington, D. C.

12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr. = Twelfth Annual Report of the United States Geological and Geographical Survey of the Territories, by F. V. Hayden, U. S. geologist, Washington, D. C.

U. S. & Mex. Bound. Survey, Vol. I = United States and Mexican Boundary Survey, Report of William H. Emory, Washington, D. C.

TRIASSIC SPECIES.

Acrochordiceras hyatti Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 124, pl. xi, figs. 5, *a*. Mus. No. 12514.

Arcestes ——— ? White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 117. Mus. No. 8194.

Arcestes ? cirratus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 116. Mus. No. 8192.

Arcestes gabbi Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 121, pl. x, figs. 6, *a*. Mus. No. 12523.

Arcestes ? perplanus Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 120, pl. xi, figs. 7, *a*. Mus. No. 12531.

Aviculopecten ? altus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 110, pl. xxxii, fig. 3*a*. Mus. No. 8189.

Aviculopecten ? idahoensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 110, pl. xxxii, fig. 2*a*. Mus. No. 8187.

TRIASSIC SPECIES—Continued.

Aviculopecten? pealei White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 109, pl. xxxii, fig. 4*a*. Mus. No. 8188.

Clydonites lævidorsatus (Hauer sp.) Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 109, pl. x, fig. 7, *a*. Mus. No. 12522.

Discina sp. und. Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 99, pl. x, figs. 3, *a*. Mus. No. 13387.

Eutomoceras laubei Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 126, pl. x, figs. 8, *a*. Mus. No. 12528.

Gymnotoceras blakei (Gabb sp.) Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 113, pl. x, figs. 10, *a*, *b*; pl. xi, figs. 6, *a*. Mus. No. 12512.

Gymnotoceras rotelliforme Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 111, pl. x, figs. 9, *a*. Mus. No. 12526.

Halobia (Daonella) lommeli (Wissman) Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 100. (Marked as types by Meek, but are not the figured specimens.) Mus. No. 12518.

Meekoceras aplanatum White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 112, pl. xxxi, figs. 1*a–d*. Mus. No. 8185.

Meekoceras gracilitatis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 115, pl. xxxi, figs. 2*a–d*. Mus. No. 8182.

Meekoceras mushbachianum White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 114, pl. xxxii, figs. 1*a–d*. Mus. No. 8186.

Modiomorpha? lata Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 103, pl. x, fig. 2. Mus. No. 12519.

Modiomorpha ? ovata Meek?
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 103, pl. x, figs. 1, *a*. Mus. No. 1253.

Orthoceras blakei (Gabb?) Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 104, pl. x, fig. 11. Mus. No. 12516.

Sphæra whitneyi Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 102, pl. x, figs. 4, *a*, *b*. Mus. No. 12511. Fig. 4*c*. Mus. No. 12524.

Spirifera (Spiriferina ?) alia H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 281, pl. vi, fig. 17. Mus. No. 12671.

Terebratula angusta (H. & Whitf.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 109. Mus. No. 8191.

Terebratula humboltensis (Gabb) H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 282, pl. vi, figs. 22–24. Mus. No. 12533.

Terebratula semisimplex White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 108, pl. xxxi, figs. 3*a–c*. Mus. No. 8190.

Trachyceras judicaricum (Mojsisovics) Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 118, pl. xi, figs. 1, *a*. Mus. No. 12529.

Trachyceras whitneyi (Gabb sp.) Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, p. 116, pl. xi, figs. 3, *a*. Mus. No. 12527.

JURASSIC SPECIES.

Ammonites cordiformis Meek.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 122, pl. v, figs. 2*a*–*c*. Mus. No. 203.

Ammonites cordiformis (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 378, pl. vi, figs. 22, 23. Mus. No. 12345. Figs. 20, 21. Mus. No. 12294.

Ammonites cordiformis var. **distans** Whitf.
Rep. Geol. Black Hills of Dakota, p. 380, pl. vi, fig. 25. Mus. No. 12308.

Ammonites henryi Meek.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 123, pl. iv, figs. 9*a*–*c*. Mus. No. 314.

Ammonites pickeringi Dana.
U. S. Expl. Exp., vol. x, geology, p. 721, pl. xv, fig. 5. Mus. No. 3582.

Amussium aurarium Meek.
Geol. Surv. California, geology, vol. i, p. 478, pl. i, figs. 6, *a*. Mus. No. 7831.

Astarte? inornata (M. & H.) Meek.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 9, 4pl. iii, figs. 12*a*, *b*. Mus. No. 202.

Astarte packardi White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 149, pl. 37, figs. 6*a*, *b*. Mus. No. 8361. (Casts original in collection of Professor Packard.)

Asterias ? dubium Whitfield.
Rep. Geol. Black Hills of Dakota, p. 344, pl. iii, fig. 3. Mus. No. 12325.

Aucella concentrica Fischer var. White.
Juras. Neocomian. Bull. U. S. Geol. Surv., No. 4, p. 101, pl. vi, figs. 2–12. Mus. No. 12360.

Aucella erringtoni (Gabb sp.) Meek.
Geol. Surv. California, geology, vol. i, p. 479, pl. i, figs. 2*a*, [5, *e*]. Mus. No. 7831.

Avicula (Oxytoma) mucronata (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 357, pl. iv, figs. 1, 2. Mus. No. 12342.

Aviculopecten ? superstrictus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 144, pl. xxxvii, figs. 4*a*, *b*. Mus. No. 8173.

Aviculopecten (Eumicrotis) augustensis H. & Whitf.
Geol. Expl. 40th Parallel, vol. iv, part ii, p. 288, pl. vii, fig. 15. Mus. No. 12547.

Aviculopecten ? Eumicrotis augustensis H. & Whitf.
Geol. Expl. 40th Parallel, vol. iv. part ii, p. 288 [pl. vii, fig. 14]. Mus. No. 12513.

Belemnites densus (M. & H.) Meek.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 126, pl. iv, fig. 10*c*; pl. v, figs. 1*b*–*d*, *f*–*i*. Mus. No. 195.

Belemnites densus (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 381, pl. vi, figs. 15–19. Mus. No. 12293.

Belemnites macritatis White.
Juras. Neocomian. Bull. U. S. Geol. Surv., vol. i, No. 4, p. 102, pl. vi, figs. 13, 14. Mus. No. 12361.

Belemnites nevadensis Meek.
Geol. Expl. 40th Parallel, vol. iv, part i, p. 138, pl. xii, figs. 7, *a*, *b*. Mus. No. 12515. [Figs. 8, *a*, *b*.] Mus. No. 12517.

JURASSIC SPECIES—Continued.

Camptonectes bellistriatus (Meek) Whitfield.
Rep. Geol. Black Hills of Dakota, p. 351, pl. iv, fig. 7. Mus. No. 12339.

Camptonectes extenuatus (M. & H.) Meek.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 78, pl. iii, fig. 6. Mus. No. 221.

Camptonectes extenuatus (M. & H.) H. & Whitf.
Geol. Expl. 40th Parallel, vol. iv, part ii, p. 290, pl. vii, fig. 18. Mus. No. 12552.

Camptonectes extenuatus (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 353, pl. iv, fig. 4. Mus. No. 12335.

Camptonectes pertenuistriatus H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 291, pl. vii, fig. 17. Mus. No. 12535.

Camptonectes platessiformis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 143, pl. xxxvii, fig. 5*a*. Mus. No. 8179.

Camptonectes stygius White.
Rep. Geogr. & Geol. Expl. & Surv. west 100th Meridian, vol. iv, p. 164, pl. xiii, figs. 2*a–c*. Mus. No. 8580.

Cardinia præcisa White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 149, pl. xxxvii, figs. 7*a*, *b*. Mus. No. 8174.

Dentalium subquadratum M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 111, fig. on p. 111. Mus. No. 677.

Dosinia jurassica Whitfield.
Rep. Geol. Black Hills of Dakota, p. 373, pl. v, figs 21–24. Mus. No. 12282.

Eumicrotis curta (Hall sp.) M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 81, pl. iii, figs. 10*a–d*. Mus. No. 205.

Gervillia montanaensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 145, pl. xxxvii, figs. 1*a*, *b*. Mus. No. 7795.

Gervillia recta (Meek) Whitf.
Rep. Geol. Black Hills of Dakota, p. 358, pl. iv, fig. 3. Mus. No. 12319.

Goniomya montanaensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 151, pl. xxxvii, fig. 8*a*. Mus. No. 7814.

Grammatodon inornatus M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 90, pl. iii, figs. 9, *a*, *b*. Mus. No. 201.

Gryphæa calceola (Quenst.) var. **nebrascensis** M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 74, pl. iii, figs. 1*a–f*. Mus. No. 318.

Gryphæa calceola (Quenst.) var. **nebrascensis** (M. & H.) H. & Whitf.
Geol. Expl. 40th Parallel, vol. iv, part ii, p. 286, pl. vii, fig. 11. Mus. No. 12540.

Inoceramus crassalatus White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, p. 166, pl. xiii, figs. 4*a–c*. Mus. No. 8585.

Lima (Plagiostoma) occidentalis H. & Whitf.
Geol. Expl. 40th Parallel, vol. iv, part ii, p. 292, pl. vii, fig. 23. Mus. No. 12539.

Lingula brevirostris M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 69, pl. iii, figs. 3*a*, *b*. Mus. No. 206.

JURASSIC SPECIES—Continued.

Lingula brevirostris (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 346, pl. iii, figs. 4, 5. Mus. No. 12310.

Lioplacodes veternus M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 116, fig. on p. 116. Rev. Non-Marine Foss. Moll., p. 64 or 470, pl. iii, fig. 9. Mus. No. 1978.

Lyosoma powelli White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 153, pl. xxxviii, figs. 6*a–d*. Mus. No. 8181.

Myacites nebrascensis M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 100, pl. iv, fig. 5. Mus. No. 210.

Myacites subcompressus (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 151, pl. xxxviii, figs. 5*a–e*. Mus. Nos. 8061, 8180.

Myacites subellipticus M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 101, pl. iv, figs. 6, *a–c*. Mus. No. 200.

Myacites (Pleuromya) weberensis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, p. 137, pl. xii, figs. 11, *a*. Mus. No. 13386.

Myophoria ambilineata White.
Rep. Geogr. & Geol. Expl. & Surv. west 100th Meridian, vol. iv, p. 166, pl. xiii, figs. 5*a*, *b*. Mus. No 8586.

Mytilus whitei Whitf.
Rep. Geol. Black Hills of Dakota, p. 360, pl. v, figs. 9–12. Mus. No. 12312.

Mytilus whitei (Whitf.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 147, pl. xxxvii, fig. 9*a*. Mus. No. 8177.

Natica ? lelia H. & Whitf.
Rep. Geol Expl. 40th Parallel, vol. iv, part ii, p. 298, pl. vii, figs. 19–21. Mus. No. 12536.

* **Neæra longirostra** Whitf.
Rep. Geol. Black Hills of Dakota, p. 376, pl. v, fig. 35. Mus. No. 12327.

† **Neritella nebrascensis** M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 109, figs. on p. 109. Rev. Non-Marine Foss. Moll., p. 51 or 457, pl. iii. Mus. No. 1979.

Neritina ? phaseolaris White.
Rep. Geogr. & Geol. Expl. Surv. w. 100th Meridian, vol. iv, p. 167, pl. xiii, figs. 1*a–d*. Mus. No. 8587.

Ostrea engelmanni (Meek) M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 73, fig. A on p. 73. Rev. Foss. Ostreidæ N. A., p. 289, pl. xxxiv, figs. 4 & 5. Mus. No. 1884.

Ostrea engelmanni ? (M. & H.) H. & Whitf.
Rep. Geol. Surv. 40th Parallel, vol. iv, part ii, p. 285, pl. vii, fig. 12. Mus. No. 12534.

Ostrea strigilecula White.
Rep. Geogr. & Geol. Expl. & Surv. w. 100th Meridian, vol. iv, p. 163, pl. xiii, fig. 3*d*. Rev. Foss. Ostreidæ N. A., p. 289, pl. xxxv, fig. 11. Mus. No. 8581.

Ostrea strigilecula (White) Whitf.
Rep. Geol. Black Hills of Dakota, p. 348, pl. iii, figs. 8–10, 12. Mus. No. 12318. Fig. 11. Mus. No. 12271.

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* I cannot recognize the type, but it is marked as such by the author of the species.
† Dr. White, in the Non-Marine Foss. Mollusca, refers this species to *Neritina*.

JURASSIC SPECIES—Continued.

Pentacrinites astericus ? M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 67, fig. on p. 67. Mus. No. 682.

Pentacrinus astericus (M. & H.) White.
Rep. Geogr. & Geol. Expl. & Surv. west 100th Meridian, vol. iv, p. 162, pl. xiii, figs. 6*a*, *b*. Mus. No. 8588.

Pholadomya humilis (Meek) M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 81, pl. iv, figs. 3*a*, *b*. Mus. No. 217.

Pholadomya kingii (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 150, pl. xxxviii, figs. 3*a*, *b*. Mus. No. 7815.

Planorbis veternus M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 107, pl. iv, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 40 or 446, pl. iii, fig. 6. Mus. No. 317.

Pleuromya newtoni Whitf.
Rep. Geol. Black Hills of Dakota, p. 367, pl. v, figs. 19, 20. Mus. No. 12336.

Psammobia ? prematura Whitf.
Rep. Geol. Black Hills of Dakota, p. 374, pl. v, fig. 31. Mus. No. 12328.

Pseudomonotis (Eumicrotis) curta (Hall sp.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 354, pl. iii, figs. 24, 25. Mus. No. 12322.

Pseudomonotis (Eumicrotis) orbiculata Whitf.
Rep. Geol. Black Hills of Dakota, p. 356, pl. iii, figs. 17–19. Mus. No. 12269.

Rhynchonella ——— M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 71, pl. iii, fig. 4. Mus. No. 319.

Rhynconella gnathophora ? (Meek) H. & W.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 284, pl. vii, fig. 6. Mus. No. 12550.

Rhynconella myrina (H. & W.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 347, pl. iii, fig. 7. Mus. No. 12306. Fig. 6. Mus. No. 12280.

Saxicava jurassica Whitf.
Rep. Geol. Black Hills of Dakota, p. 376, pl. v, figs. 25–30. Mus. No. 12300.

Septocardia carditoidea H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p, 296, pl. vii, fig. 25. Mus. No. 12549.

Septocardia typica H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 295, pl. vii, figs. 26, 27. Mus. No. 12538.

Serpula ——— M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 128, pl. v, fig. 4. Mus. No. 219.

Tancredia ? æquilateralis M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 96, [pl. iii, fig. 8]. Mus. No. 198.

Tancredia bulbosa Whitf.
Rep. Geol. Black Hills of Dakota, p. 370, pl. vi, figs. 1, 2. Mus. Nos. 12321, 12328.

Tancredia corbuliformis Whitf.
Rep. Geol. Black Hills of Dakota, p. 370, pl. vi, figs. 5–8. Mus. Nos. 12328, 12282.

Tancredia extensa White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 150, pl. xxxviii, fig, 4*a*. Mus. No. 8176.

JURASSIC SPECIES—Continued.

Tancredia? inornata (M. & H. sp.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 368, pl. vi, fig. 13. Mus. No. 12338. Figs. 9–12. Mus. No. 12341.

Tancredia postica Whitf.
Rep. Geol. Black Hills of Dakota, p. 371, pl. vi, fig. 14. Mus. No. 12321.

Tancredia warrenana M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 96. Mus. No. 204.

Tancredia warrenana (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 372, pl. vi, fig. 4. Mus. No. 12326.

Terebratula angusta H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 285, pl. vii, figs. 7–10. Mus. No. 12548.

Thracea? sublævis (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 375, pl. v, fig. 34 (by mistake marked 24 on the plate). Mus. No. 12327.

Thracia? arcuata M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 102, pl. iv, fig. 8. Mus. No. 211.

Thracia? sublævis M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 102, pl. iv, figs. 4, *a*. Mus. No. 197.

Trapezium bellefourchensis Whitf.
Rep. Geol. Black Hills of Dakota, p. 364, pl. v, figs. 1–4. Mus. No. 12303.

Trapezium subequalis Whitf.
Rep. Geol. Black Hills of Dakota, p. 365, pl. v, fig. 6. Mus. No. 12317. Figs. 5, 7, 8. Mus. No. 12329.

Trigonia americana (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 148, pl. xxxviii, figs. 1*a*, *b*. Mus. Nos. 7794, 7819.

Trigonia conradi M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 83, pl. iii, fig. 11. Mus. No. 212.

Trigonia montanaensis (Meek) White.
12th Ann. Rep. U. S. Geol. & geogr. Surv. Terr., p. 147, pl. xxxviii, fig. 2*a*. Mus. No. 7817.

Trigonia quadrangularis H. & Whitf.
Rep. Geol. Expl. 40th Parallel, vol. iv, part ii, p. 293, pl. vii, fig. 22. Mus. No. 12537.

Unio nucalis M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 92, pl. iii, figs. 13*a*–*c*. Rev. Non-Marine Foss. Moll., p. 20 or 426, pl. iii, fig. 4. Mus. No. 196.

Unio stewardi White.
Non-Marine Foss. Moll., p. 20 or 426, pl. iii, fig. 1. Mus. No. 8849.

Valvata? scabrida M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 113, pl. iv, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 64 or 470, pl. iii, fig. 7. Mus. No. 316.

Volsella formosa M. & H.
Pal. Upper Missouri, <Smithsonian Cont. to Know. 172, p. 86, figs. A, B, on p. 87. Mus. No. 1882.

Volsella scalprum (Sow. sp.) var. **isonema** Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 132, pl. xii, fig. 4. Mus. No. 12545.

Volsella (Modiolina) platynota White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 146, pl. xxxvii, figs. 3*a*, *b*. Mus. No. 8175.

Volsella subimbricata (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 145, pl. xxxvii, figs. 2*a*–*c*. Mus. Nos. 8178, 7818.

CRETACEOUS SPECIES.

Acmæa occidentalis (H. & M. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 295, pl. xviii, figs. 3*a*–*c*. Mus. No. 250.

Acmæa? papillata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 296, pl. xxxi, figs. 4*a*, *b*. Mus. No. 251.

Actæon attenuatus (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 281, pl. xix, figs. 17*a*, *b*. Mus. No. 285.

Actæon subellipticus (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 280, pl. xix, fig. 16. Mus. No. 283.

Actæon woosteri White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 304, pl. vii, figs. 9*a*–*c*. Mus. No. 8096.

Actæonina prosocheila White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 305, pl. vii, figs. 10*a*, *b*. Mus. No. 8095.

Admete (Admetopsis) gregaria (Meek) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 198, pl. xviii, figs. 5*a*, *b*. Mus. No. 8651.

Admetopsis rhomboides (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 317, pl. ix, figs. 6*a*, *b*. Mus. No. 7893.

Admetopsis subfusiformis (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 318, pl. ix, fig. 7*a*. Mus. No. 7892.

Akera glansoryza Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 437, pl. xii, fig. 25. Mus. No. 12331.

Amauropsis paludinæformis (H. & M. sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 431, pl. xii, fig. 16. Mus. No. 12302.

Amauropsis paludinæformis (H. & M. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. Surv. Terr., 4to, vol. ix, p. 318, pl. xix, figs. 15*a*–*c*. Mus. No. 268.

Ammonites complexus (H. & M.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 447, pl. xxiv, figs. 1*a*–*c*. Mus. No. 381.

Ammonites complexus var. **suciaensis** Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 369, pl. v, figs. 2*a*–*c*. Mus. Nos. 1276, 12396.

Ammonites lævianus White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 201, pl. xix, figs. 1*a*, *b*. Mus. No. 8629.

CRETACEOUS SPECIES—Continued.

Ammonites leonensis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 160, pl. xvi, figs. 2*a*, *b*. Mus. No. 9878.

Ammonites?? mullananus (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 607, pl. viii, figs. 1*a–c*. Mus. No. 1924.

Ammonites newberryanus Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 367, pl. iv, figs. 3, *a*, *b*. Mus. No. 12394.

Ammonites placenta De Kay var. **intercalaris** (M. & H.) White.
Rep. Geogr. & Geol. Surv. west 100th Meridian, vol. iv, part i, p. 202 (not figured). Mus. No. 8637.

Ammonites pleurisepta Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 159, pl. xv, figs. 1*a–c*. Mus. No. 9888.

* **Ammonites texanus** (Rœmer) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 159. Mus. No. 9893.

Anchura (Drepanocheilus) americana (E. & S. sp.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 325, pl. xxxii, figs. 8*a*, *b*. Mus. No. 274.

Anchura (Drepanocheilus) mudgeana White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 312, pl. vii, figs. 3*a*, *b*. Mus. No. 8086.

Anchura (Drepanocheilus) nebrascensis (E. & S. sp.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 429, pl. xii, figs. 2, 3. Mus. No. 12309.

Anchura (Drepanocheilus) nebrascensis (E. & S. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 326, pl. xix, figs. 5*a–c*. Mus. No. 288.

Anchura (Drepanocheilus) prolabiata White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 313, pl. vii, fig. 2*a*. Mus. No. 8069.

Anchura (Drepanocheilus) ruida White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 312, pl. vii, figs. 4*a*, *b*. Mus. No. 8078.

Anchura ? fusiformis (Meek) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 190, pl. xviii, fig. 4*a*. Mus. No. 8648.

Anchura ? fusiformis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 160, [pl. xv, figs. 2, *a*]. Mus. No. 12429.

Anchura haydeni White.
Cret. No. 4. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 311, pl. vii, fig. 1*a*. Mus. No. 8054.

Anchura ? parva Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 328, pl. xix, figs. 4*a*, *b*. Mus. No. 284.

Anchura ? sublevis (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 327, pl. xix, figs. 3*a*, *b*. Mus. No. 276.

Anchura ? sublevis (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 428, pl. xii, fig. 6. Mus. No. 12344.

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* Not the figured specimen, but marked as a type by T. A. Conrad.

CRETACEOUS SPECIES—Continued.

Ancyloceras jenneyi Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 452, pl. xvi, figs. 7–9. Mus. No. 12295.

Ancyloceras tricostatus Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 454, pl. xv, figs. 7, 8. Mus. No. 12287.

Ancyloceras ? uncum (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 409, pl. xxi, figs. 1*a*, *b*. Mus. No. 387.

Anisomyon alveolus (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 292, pl. xviii, figs. 4*a*, *b*. Mus. No. 247.

Anisomyon alveolus (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 433, pl. xii, fig. 20. Mus. No. 12278.

Anisomyon borealis (Morton sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills, of Dakota, p. 436, pl. xii, fig. 23. Mus. No. 12254.

Anisomyon borealis (Morton sp.) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 193, pl. xviii, figs. 9*a*, *b*. Mus. No. 8649.

Anisomyon borealis (Morton sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 288, pl. xviii, figs. 9*a–e*. Mus. No. 248.

Anisomyon centrale (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 289, pl. xviii, figs. 7*a–c*. Mus. No. 245.

Anisomyon centrale (Meek) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 194, pl. xviii, figs. 8*a*, *b*. Mus. No. 8659.

Anisomyon centrale (Meek) White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 303, pl. ix, figs. 1*a–d*. Mus. No. 12430.

Anisomyon patelliformis (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 290, pl. xviii, figs. 5*a–c* [*e*], *f*. Mus. No. 246.

Anisomyon patelliformis (M. & H.) Whitf.
Cret. No. 2. Rep. Geol. Black Hills of Dakota, p. 435, pl. xii, figs. 17, 18. Mus. No. 12268.

Anisomyon sexsulcatus (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 293, pl. xviii, figs. 8*a*, *b*. Mus. No. 249.

Anisomyon subovatus (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 291, pl. xviii, figs. 5*d*, 6. Mus. No. 244.

Anisomyon subovatus (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 434, pl. xii, fig. 19. Mus. No. 12298.

Anomia concentrica Meek.
Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 359, pl. iv, fig. 3. Mus. No. 489.

Anomia ? obliqua (M. & H.) Meek.
Cret. No. 3. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 22, pl. ix, fig. 2. Mus. No. 241.

Anomia propatoris White.
12th Ann. Rep U. S. Geol. & Geogr. Surv. Terr., p. 14, pl. xii, figs. 15*a*, *b*. Rev. Non-Marine Foss. Moll., p. 16 or 422, pl. v, figs. 6, 7. Mus. No. 7874.

CRETACEOUS SPECIES—Continued.

Anomia ræetiformis Meek.
Cret. No. 5. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 141, fig. 1 on p. 141. Mus. No. 8047.

Anomia ? subtrigonalis (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 22, pl. xvi, figs. 4*a*, *b*. Mus. No. 346.

Aporrhais biangulata (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 322, pl. xix, figs. 6*a–c*; fig. 37 on page 322. Mus. No. 275.

Aporrhais meeki Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 426, pl. xii, fig. 5. Mus. No. 12334.

Aptychus cheyennensis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p, 438, pl. xxxv, figs. 3*d*, *f–i*. Mus. No. 386.

Arca ? equilateralis Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 357, pl. ii, figs. 6, *a*. Mus. No. 12386.

Arca subelongata Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 148, pl. vi, figs. 3*a*, *b*. Mus. No. 9846.

Astarte evansi (H. & M. sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 413, pl. xi, fig. 13. Mus. No. 12343.

Astarte texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 152, pl. v, fig. 9. Mus. No. 9829.

Avicula (Pseudoptera) propleura (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 281, pl. x, figs. 2*b–c*. Mus. No. 7788.

Axinæa subimbricata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 95, pl. xxviii, figs. 14*b–d*. Mus. No. 309.

Axinea wyomingensis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 149, figs. 2, 3, on p. 150. Mus. No. 8045.

Baculites asper (Morton ?) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 404, pl. xxxix, figs. 10*a–d*. Mus. No. 178.

Baculites compressus (Say) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 400, pl. xx, figs. 3*a–c*. Mus. No. 378.

Baculites grandis (H. & M.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 398, pl. xxxiii, figs. 1*a–c*. Mus. No. 380.

Baculites occidentalis Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 366, pl. iv, figs. 1, *a*, *b*. Mus. No. 1363.

Baculites ovatus (Say) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 394, pl. xx, figs. 3*a–c*. Mus. No. 374.

Baculites ovatus (Say) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 199, pl. xix, figs. 5*a–c*, 4*a–c*. Mus. Nos. 8630, 8631.

Barbatia barbatula White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 19, pl. xi, fig. 5*a*. Mus. No. 8071.

CRETACEOUS SPECIES—Continued.

Barbatia coalvillensis White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 286, pl. vi, figs. 2*a*, *b*. Mus. No. 8067.

Baroda subelliptica White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 294, pl. x, figs. 4*a–d*. Mus. No. 8048 *bis*.

Baroda wyomingensis (Meek) White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 293, pl. x, figs. 3*a*, *b*. Mus. No. 1939.

Beaumontia ? solitaria White.
Cret. No. 5. 12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 8, pl. xii, fig. 13*c*. Mus. No. 8079.

Belemnitella bulbosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 504, pl. xxxiii, figs. 2*c–e*. Mus. No. 412.

Buccinopsis parryi Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 158, pl. xiii, figs. 5*a*, *b*. Mus. No. 9881.

Buchiceras swallovi (Shumard sp.) White.
Rep. U. S. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 202, pl. xx, figs. 1*a–c*. Mus. No. 8628.

Callista (Aphrodina ?) tenuis (H. & M.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 188, pl. v, figs. 1*a–d*. Mus. No. 232.

Callista (Dosiniopsis) deweyi (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 182, pl. xvii, figs. 15*a–e*. Mus. No. 341.

Callista (Dosiniopsis) nebrascensis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 184, fig. 15 on p. 184. Mus. No. 1938.

Callista (Dosiniopsis) orbiculata (H. & M.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 186, pl. v, figs. 2*a–c*. Mus. No. 231.

Callista (Dosiniopsis) owenana (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 183, pl. xxxvii, fig. 1. Mus. No. 176.

Callista ? pellucida (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 187, pl. xvii, figs. 10*a–e*. Mus. No. 418.

Camptonectes platessa White.
Rep. Geogr, & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 176, pl. xvii, fig. 5*a*. Mus. No. 8643.

Cantharus ? julesburgensis White.
Cret. No. 5. Proc. U. S. Nat. Mus., vol. iv, p. 138, pl. —, figs. 1, 2. Mus. No. 12494.

Cantharus (Cantharulus) vaughani (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 379, pl. xxxii, figs. 5*a*, *b*; fig. 48 on p. 379. Mus. No. 255.

Caprina occidentalis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 147, pl. ii, figs. 1*a–c*. Mus. No. 9840.

CRETACEOUS SPECIES—Continued.

Caprina planata Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 147, pl. ii, figs. 2*a*, *b*. Mus. No. 9891.

Capsa texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 164, pl. xxi, fig. 6. Mus. No. 12496.

Cardita eminula Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 150, pl. vi, fig. 8. Mus. No. 9847.

Cardita subtetrica Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 164, pl. xxi, fig. 5. Mus. No. 9828.

Cardium congestum Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 149, pl. vi, figs. 5*a–d*. Mus. No. 9882.

Cardium (Criocardium) speciosum (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 169, pl. xxxvii, figs. 4*a–c*. Mus. No. 190. (*Ethmocardium* White.)

Cardium curtum (M. & H.) Meek.
Geol. Expl. 40th Parallel, vol. iv, part i, p. 151, pl. xv, fig. 3. Mus. No. 7855.

Cardium ? kansasense Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 170, pl. ii, figs. 14*a*, *b*. Mus. No. 7905.

Cardium mediale Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 149, pl. iv, figs. 4*a*, *b*. Mus. No. 9860.

Cardium (Protocardia) filosum Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 150, pl. vi, figs. 7*a*, *b*. Mus. No. 9868.

Cardium (Protocardia) multistriatum (Shumard) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 149, pl. vi, figs. 4*a–c*. Mus. No. 9858.

Cardium (Protocardia) texanum Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 150, pl. vi, figs. 6*a–c*. Mus. No. 9884.

* **Cardium pauperculum** (Meek) White.
Cret. No. 2. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 291. Mus. No. 7832.

Cardium subcurtum Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 152, pl. xv, fig. 3*a*. Mus. No. 12448.

Cardium trite White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 291, pl. v, fig. 4*b*. Mus. No. 8060.

Caryophyllia egeria White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 275, pl. vi, figs. 7*a*, *b*. Mus. No. 8083.

Caryophyllia johannis White.
Cret. Nos. 4, 5 ? 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 274, pl. vi, figs. 6*a*, *b*. Mus. No. 8084.

Cassiope whitfieldi White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 196, pl. xviii, fig. 1*a*. Mus. No. 8633.

Cerithiopsis moreauensis Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 335, pl. xxxi, fig. 4; p. 336, fig. 38. Mus. No. 293.

Chætetes ?? dimissus White.
Cret. No. 5. 12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 7, pl. xii, fig. 14*a*. Mus. No. 8080.

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* Not the figured specimen, but marked as a type by C. A. White.

CRETACEOUS SPECIES—Continued.

Chemnitzia cerithiformis Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 339, pl. xxxii, figs. 10*a*, *b*. Mus. No. 263.

Chlamys nebrascensis (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 25, pl. xvi, figs. 6*a–c*. Mus. No. 358.

Closteriscus tenuilineatus (H. & M. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 308, pl. xix, figs. 10*a*, *b*, 9*c*. Mus. No. 260.

Corbicula nucalis Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 163, pl. ii, figs. 5*a–c*. Mus. No. 7898.

Corbula crassimarginata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 244, pl. xvii, figs. 14*a–c*. Mus. No. 299.

Corbula nematophora (Meek) White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 188, pl. xvii, figs. 7*a–c*. Mus. No. 8662.

Corbula nematophora (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 290, pl. iii, figs. 4*a–d*. Mus. Nos. 7830, 7891.

Corbulamella gregaria Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 247, pl. xvii, figs. 13*a–d*. Mus. No. 355.

Crassatella cimarronensis White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 287, pl. v, figs. 3*a–c*. Mus. No. 8053.

Crassatella (Pachythærus) evansi (H. & M.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 117, pl. xvii, figs. 6*a–d*. Mus. No. 322.

Crassatella subquadrata Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 412, pl. xi, fig. 12. Mus. No. 12301.

Crenella elegantula (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 75, pl. xxviii, figs. 6*a–c*. Mus. No. 1925.

Cucullæa (Idonearca?) cordata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 89, pl. xxix, figs. 6*a*, *b*. Mus. No. 430.

Cucullæa (Idonearca) nebrascensis (Owen) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 88, pl. xxix, figs. 5*a*, *b*. Mus. No. 442.

Cucullæa (Idonearca) shumardi (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 86, pl. xxviii, figs. 15*a–g*; pl. xxix, fig. 4. Mus. No. 443.

Cucullæa terminalis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 148, pl. iv, figs. 1*a*, *b*. Mus. No. 9890.

Cucullæa (Trigonarca?) obliqua Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i. p. 148, pl. xiv, figs. 1, *a*. Mus. No. 7849.

Cylichna scitula Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 276, pl. xxxi, figs. 3*a*, *b*. Mus. No. 282.

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CRETACEOUS SPECIES—Continued.

Cylichna? volvaria M. & H.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 275, pl. xxxi, figs. *2a, b.* Mus. No. 281.

Cyphosoma texanum (Rœmer) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 145, pl. i, fig. 3*c*? Mus. No. 9838.

Cyprimeria? subalata Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 158, pl. xv, fig. 7. Mus. No. 7848.

Cyprimeria ? tenuis Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 361, pl. ii, fig. 5. Mus. No. 1319.

Cyprina ovata (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 146, pl. xxix, figs. 7*a–c*; fig. 8, p. 146. Mus. No. 306.

***Cyrena carletoni** (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 20. Mus. No. 7877.

Cyrena dakotensis (M. & H.) Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 159, pl. i, figs. 1*a–d, f*. Rev. Non-Marine Foss. Moll., p. 30 or 436, pl. iv, figs. 3, 4. Mus. Nos. 192, 7901.

Cyrena ? holmesi Meek.
Cret. No. 5. Bull. U. S. Geol. & Geogr. Surv. Terr., vol. i (2d ser.), No. 1, p. 45 (not figured). Mus. No. 7840.

Cyrena inflexa (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 290 pl. x, figs. 7*a, b*. Mus. No. 7822.

Cyrena securis (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 289, pl. iii, figs. 2*a–c*. Mus. No. 8073.

Cytherea leonensis Conrad.
U. S. Mex. Bound. Surv., vol. i, part ii, p. 153, pl. vi, fig. 1. Mus. No. 9853.

Cytherea nuttalli Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 162, pl. iv, fig. 5. Mus. No. 9905.

Cytherea texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 153, pl. vi, fig. 2. Mus. No. 9850.

Dentalium gracile (H. & M.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 438, pl. xii, fig. 26. Mus. No. 12299.

Dentalium gracile (H. & M.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 266, [pl. xviii, figs. 13*a–d*]. Mus. No. ——.

Dentalium komooksense Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 364, pl. iii, fig. 6. Mus. No. 4270.

Dosinia missouriana (Morton sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 416, pl. xi, figs. 25, 26. Mus. No. 12249.

Endocostea sulcata (Rœmer sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 404, pl. x, fig. 6. Mus. No. 12323.

* Not the figured specimen, but marked as a type by Dr. C. A. White.

CRETACEOUS SPECIES—Continued.

Endocostea typica Whitfield.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 403, pl. ix, figs. 1–6. Mus. No. 12261.

Entalis ? paupercula (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 269, pl. xviii, fig. 14. Mus. No. 311.

Eriphyla gregaria (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 124, pl. xvii. figs. 9*a*, *b*; figs. 6, 7, on p. 124. Mus. No. 332.

Ethmocardium speciosum (M. & H. sp.) White.
Proc. U. S. Nat. Mus., vol. ii, p. 291 (types of subgenus). Mus. No. 8049.

Eulimella ? chrysallis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 32, pl. xii, fig. 4*a*. Mus. No. 7869.

Eulimella ? funicula (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 316, pl. ix, fig. 10*a*. Mus. No. 7881.

Eulimella ? inconspicua (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 33, pl. xii, fig. 5*a*. Mus. No. 7871.

Euspira utahensis White.
Cret. No. 4 or 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 310, pl. iv, figs. 2*a*, *b*. 12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 29. Mus. No. 8068.

Exogyra arietina (Rœmer) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 153, pl. vii, figs. 1*c*–*e*. Mus. No. 9866.

Exogyra costata (Say) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 154, pl. ix, figs. 2*a*, *b*; pl. x, fig. 1. Mus. No. 9879.

Exogyra costata (Say) var. **fluminis** White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 174, pl. xvii, figs. 3*c*, *d*. Mus. No. 8654.

Exogyra fimbriata Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 154, pl. vii, figs. 2, *a*, *b*. Mus. No. 9864.

Exogyra forniculata White.
Proc. U. S. Nat. Mus., vol. ii, p. 293, pl. iv, figs. 3, 4. Rev. Foss. Ostreidæ N. A., p. 305, pl. lii, figs. 1, 2. Mus. No. 8022.

Exogyra fragosa Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 155, pl. viii, figs. 2*a*, *b*. Mus. No. 9844.

Exogyra læviuscula (Rœmer) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 173, pl. xvii, fig. 2*a*. Mus. No. 8646.

Exogyra matheroniana (d'Orbigny) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 154, pl. viii, figs. 1*a*–*c*. Mus. No. 9883.

Exogyra ponderosa (Rœmer) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 172, pl. xiv, figs. 1*a*–*c*. Mus. No. 13417.

Exogyra winchelli White.
Proc. U. S. Nat. Mus., vol. ii, p. 294, pl. ii, figs. 1, 2; pl. iii, figs. 1, 2. Rev. Foss. Ostreidæ N. A., p. 307, pl. lii, figs. 6, 7; pl. lv, figs. 1, 2. Mus. No. 8021.

Fasciolaria buccinoides (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 358, pl. xxxi, figs 8*a*–*d*. Mus. No. 272.

Fasciolaria ? (Cryptorhytis) cheyennensis Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 365, pl. xix, figs. 13*a*, *b*. Mus. No. 289.

CRETACEOUS SPECIES—continued.

Fasciolaria (Cryptorhytis) contorta (Meek sp.) Whitf.
Cret. Nos. 4, 5. Rep. Geol. Black Hills of Dakota, p. 422, pl. xii, fig. 10. Mus. No. 12256.

Fasciolaria ? (Cryptorhytis) flexicostata (M. & H. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 367, pl. xix, fig. 2. Mus. No. 262.

Fasciolaria (Piestocheilus) alleni White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 34, pl. xii, fig. 1*a*. Mus. No. 8046.

Fasciolaria (Piestocheilus) culbertsoni Meek.
Cret. No. 5. Rep. U. S. Geol. Surv. Terr., 4to, vol. ix, p. 360, pl. xxxii, figs. 1*a–f*. Mus. No. 258.

Fasciolaria (Piestocheilus) culbertsoni (M. & H.) Whitf.
Cret. Nos. 4, 5. Rep. Geol. Black Hills of Dakota, p. 423, pl. xii, fig. 11. Mus. No. 12264.

Fasciolaria (Piestocheilus ?) galpiniana Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 362, pl. xxxii, figs. 2*a*, *b*. Mus. No. 287.

Fasciolaria (Piestocheilus) scarboroughi Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 359, pl. xxxii, figs. 4, *a–d*. Mus. No. 259.

Fusus cheyennensis Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 424, pl. xii, fig. 9. Mus. No. 12304.

Fusus (Neptunea ?) gabbi (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 317, pl. ix, fig. 9*a*. Mus. No. 7886.

Fusus (Serrifusus) dakotensis Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 374, pl. xxxi, fig. 11*d*. Mus. No. 256.

Fusus ? (Serrifusus) dakotensis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 374, pl. xxxii, figs. 6*a*, *b*. Mus. No. 256.

Fusus ? (Serrifusus) dakotensis var. Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 375, pl. xxxii, fig. 7*a*. Mus. No. 256.

Fusus shumardi (M. & H.) Whitf.
Cret. No. 2. Rep. Geol. Black Hills of Dakota, p. 424, pl. xii, figs. 7, 8. Mus. No. 12305.

Fusus ? utahensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 34, pl. xii, fig. 2*a*. Mus. No. 7885.

Gervillia mudgeana White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 16, pl. xiv, figs. 3*a*, *b*. Mus. No. 8023.

Gervillia subtortuosa (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 65, pl. xvi, figs. 7*a–c*. Mus. No. 356.

Glycimeris berthoudi White.
Cret. No. 3 or 4. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 299, pl. vi, figs. 1*a*, *b*. Mus. No. 8051.

Glycimeris occidentalis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 250, pl. xxxix, figs. 9*a*, *b*. Mus. No. 180.

Goniomya americana (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 221, pl. xxx, figs. 12*a*, *b*. Mus. No. 432.

CRETACEOUS SPECIES—Continued.

Goniomya borealis Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 362, pl. ii, fig. 2. Mus. No. 12397.

Grammatodon ? vancouverensis Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 356, pl. iii, figs. 5, *a*. Mus. No. 12398.

Gryphæa pitcheri (Morton) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 155, pl. vii, figs. 3*a–d*. Mus. No. 9880.

Gryphæa pitcheri var. (Morton) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 171, pl. xvii, figs. 1*a–f*. Mus. No. 8653.

Gryphæa vesicularis (Lamk. ?) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr, 4to, vol. ix, p. 20, pl. xi, figs. 2*a–c*; pl. xvi, figs. 8*a*, *b*. Mus. No. 328.

Gyrodes conradi Meek.
Cret. No. 2 ? Rep. U. S. Geol. Surv. Terr., 4to, vol. ix, p. 310, figs. 33–36. Mus. No. 12459.

Gyrodes depressa Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, p. 159, pl. xv, figs. 1, *a*. Mus. No. 7856.

Hamites larvatus Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 165, pl. xxi, fig. 8. Mus. No. 9869.

Haminea occidentalis Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 271, pl. xviii, figs 11*a*, *b*, 12*a*, *b*. Mus. No. 278.

Haminea minor Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 273, pl. xxxi, figs. 1*a*, *b*. Mus. No. 280.

Haminea subcylindrica Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 272, pl. xviii, figs. 10*a*, *b*. Mus. No. 279.

Haminea subcylindrica (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 437, pl. xii, fig. 24. Mus. No. 12255.

Helicoceras mortoni (H. & M.) var. **tenuicostatum** Meek.
Cret. No. 4. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 487, pl. xxii, figs. 3*a–c*. Mus. No. 473.

Helicoceras pariense White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 203, pl. xix, figs. 2*a–d*. Mus. No. 8638.

Helicoceras stevensoni Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 447, pl. xiv, figs. 5–8. Mus. No. 12307.

Hemiaster humphreysanus Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 5, pl. x, figs. 1*a–g*. Mus. No. 331.

Heteroceras ? angulatum (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix. p. 484, pl. xxi, figs. 3*a–c*. Mus. No. 474.

Heteroceras ? cheyennense (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 483, pl. xxi, figs. 2*a*, *b*. Mus. No. 470.

Heteroceras cooperi (Gabb sp.) Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 367, pl. iii, figs. 7, *a*. Mus. No. 1350.

CRETACEOUS SPECIES—Continued.

Heteroceras ? nebrascense (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 451, pl. xv, fig. 6. Mus. No. 12292.

Heteroceras newtoni Whitf.
Rep. Geol. Black Hills of Dakota, p. 449, pl. xv, figs. 1–4. Mus. No. 12288.

Heteroceras tortum (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 481, pl. xxii, figs. 4*a–c*. Mus. No. 471.

Heteroceras ? umbilicatum (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 482, pl. xxii, fig. 5. Mus. No. 472.

Idonearca depressa White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 183, pl. xviii, figs. 13*a*, *b*. Mus. No. 8645.

Idonearca shumardi (M. & H.) Whitf.
Cret. No. 5. Rep. Geol. Black Hills of Dakota, p. 405, pl. xii, figs. 8–11. Mus. No. 12257.

Inoceramus ——— Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 359, pl. i, fig. 6. Mus. No. 12507.

Inoceramus altus (M. & H.) Whitf.
Cret. No. 2. Rep. Geol. Black Hills of Dakota, p. 391, pl. ix, fig. 11. Mus. No. 12285.

Inoceramus altus Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 43, pl, xiv, figs. 1, *a*, *b*. Mus. No. 12462.

Inoceramus balchii (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 56, pl. xv, figs. 1*a*, *b*. Mus. No. 484.

Inoceramus barabini (Morton) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 398, pl. vii, fig. 7; pl. ix, fig. 8. Mus. No. 12286.

Inoceramus barabini (Morton) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 181. Mus. No. 8626.

Inoceramus barabini (Morton) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 180, pl. xvi, fig. 4*a*. Mus. No. 8621.

Inoceramus barabini (Morton) Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 358, pl. iii, figs. 2, *a*.] Mus. No. 1262.

Inoceramus cripsii (Mantell) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 152 (not the figured specimen). Mus. No. 9892.

Inoceramus cripsii ? var. **barabini** (Morton) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 49, pl. xiii, figs. 1*a–c*. Mus. No. 477.

Inoceramus cripsii ? var. **subundatus** Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 358, pl. iii, figs. 1, *a*, 3, *a*. Mus. Nos. 1261, 1348.

Inoceramus deformis (Meek) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 179, pl. xv, fig. 1*a*. Mus. No. 8624.

CRETACEOUS SPECIES—Continued.

Inoceramus dimidius White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 181, pl. xvi, figs. *2a–d*. Mus. No. 8622.

Inoceramus erectus Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 145, pl. xiii, figs. 1, *a;* pl. xiv, fig. 3. Mus. No. 7850.

Inoceramus exogyroides (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 46, pl. v, figs. *3a–c*. Mus. No. 2038.

Inoceramus flaccidus White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 178, pl. xvi, fig. 1*a*. Mus. No. 8618.

Inoceramus fragilis (H. & M.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 42, pl. v, fig. 5. Mus. No. 228.

Inoceramus fragilis (H. & M.) Whitf.
Cret. No. 2. Rep. Geol. Black Hills of Dakota, p. 390, pl. ix, fig. 10. Mus. No. 12273.

Inoceramus fragilis (H. & M.) White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 178, pl. xv, fig. 3*a*. Mus. No. 8625.

Inoceramus gilberti White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 285, pl. iii, figs. 1*a–c*. Mus. No. 8050.

Inoceramus howelli White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 284, pl. iv, figs. 1*a–c*. Mus. No. 8052.

Inoceramus mytilopsis Conrad.
U. S. & Mex. Bound. Surv., vol. ii, part ii, p. 152, pl. v, fig. 6*b*. Mus. No. 9839.

Inoceramus oblongus (Meek) White.
Cret. No. 4. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 285, pl. ii, figs. 1*a*, *b*. Mus. No. 774.

Inoceramus perplexus Whitf.
Cret. No. 2. Rep. Geol. Black Hills of Dakota, p. 392, pl. viii, fig. 3; pl. x, fig. 5. Mus. No. 12274. Pl. x, fig. 4. Mus. No. 12263.

Inoceramus pertenuis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 47, pl. xxxvii, figs. 3*a*, *b;* pl. xxxviii, figs. 3*a*, *b*. Mus. No. 182.

Inoceramus problematicus (Schlot. sp.) Whitf.
Cret. No. 2 or 3. Rep. Geol. Black Hills of Dakota, p. 389, pl. vii, fig. 11. Mus. No. 12281.

Inoceramus problematicus (Schlot. sp.) Meek.
Cret. No. 3. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 62, pl. ix, fig. 3*a*. Mus. No. 237.

Inoceramus problematicus (Schlot. sp.) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 177, pl. xvi, fig. 3*a*. Mus. No. 8620.

Inoceramus problematicus (Schlot. sp.) Meek.
Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 358, pl. iv, fig. 1*a*. Mus. No. 488.

Inoceramus problematicus var. **aviculoides** (M. & H.) Meek.
Cret. No. 3. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 63, pl. ix, fig. 4. Mus. No. 242.

CRETACEOUS SPECIES—Continued.

Inoceramus proximus ? var. subcircularis Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 55, pl. xii, figs. 2*a*, *b*. Mus. No. 479.

Inoceramus proximus (Tuomey) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 53, pl. xii, figs. 7*a*, *b*. Mus. No. 481.

Inoceramus sagensis (Owen) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 439, pl. vii, fig. 12; pl. viii, fig. 2. Mus. No. 12313.

Inoceramus sagensis var. **nebrascensis** (Owen) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 52, pl. xiii, figs. 2*a*, *b*. Mus. No. 485.

Inoceramus simpsoni (Meek) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 395, pl. viii, fig. 1. Mus. No. 12320.

Inoceramus simpsoni ? (Meek) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 395, pl. ix, fig. 9. Mus. No. 12275.

Inoceramus sublævis (H. & M.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 393, pl. x, figs. 1–3. Mus. Nos. 12276, 12277.

Inoceramus tenuilineatus (H. & M.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 400, pl. ix, figs. 12, 13. Mus. No. 12314.

Inoceramus tenuirostris (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 59, fig. 5 on p. 59. Mus. No. 1906.

Inoceramus texanus Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 152, pl. v, fig. 7. Mus. No. 9874.

Inoceramus undabundus (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 60, pl. iii, figs. 2*a*, *b*. Mus. No. 1909.

Inoceramus umbonatus Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 44, pl. iii, figs. 1*a*, *b*; pl. iv, figs. 1*a*, *b*. Mus. Nos. 480, 2039.

Inoceramus vanuxemi (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 396, pl. vii, figs. 8, 9. Mus. No. 12296.

Inoceramus vanuxemi (M. & H.) var. Whitf.
Cret No. 4. Rep. Geol. Black Hills of Dakota, p. 398, pl. vii, fig. 10. Mus. No. 12295.

Inoceramus vanuxemi (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 57, pl. xiv, figs. 2*a*, *b*. Mus. No. 483.

Leptosolen conradi Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 253, pl. ii, figs. 12*a*, *b*. Mus. No. 7895.

Leiopistha (Cymella) undata (M. & H.) White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 187, pl. xviii, fig. 15*a*. Mus. No. 8658.

Leiopistha (Psilomya) meekii White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 186, pl. xviii, figs. 14*a*, *c*, *d*. Mus. No. 8647.

CRETACEOUS SPECIES—Continued.

Lima leonensis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 151, pl. v, figs. 3*a–c*. Mus. No. 9831.

Lima wacoensis (Rœmer) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 151, pl. v, figs. 4*a*, *b*. Mus. No. 9889.

Lima wacoensis (Rœmer) White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 176, pl. xvii, figs. 4*a–c*. Mus. No. 8656.

Limopsis parvula (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 97, pl. xxviii, figs. 17*a–c*. Mus. No. 350.

Linearia ? formosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 199, pl. xxx, fig. 2, Mus. No. 396.

Lingula subspatula (H. & M.) White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 169, pl. xv, fig. 4*a*. Mus. No. 8663.

Liopistha (Cymella) undata (M. & H. sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 187, pl. xxxix, figs. 1*a*, *b*. Mus. No. 187.

Lispodesthes lingulifera White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 192, pl. xviii, figs. 2*a*, *b*. Mus. No. 8661.

Lispodesthes nuptialis White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 192, pl. xviii, figs. 3*a*, *b*. Mus. No. 8660.

Lispodesthes ? obscurata White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 30, pl. xi, figs. 7*a*, *b*. Mus. No. 8076.

Lucina cleburni White.
Proc. U. S. Nat. Mus., vol. iv, p. 139, pl. facing p. 139, figs. 3, 4. Mus. No. 11469.

Lucina (Diplodonta ?) subundata (H. & M.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 411, pl. xi, figs. 17, 18. Mus. No. 12252.

Lucina occidentalis (Morton sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 409, pl. xi, figs. 19, 20. Mus. No. 12267.

Lucina occidentalis (Morton sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 134, pl. xvii, figs. 4*a–c*. Mus. No. 334.

Lucina occidentalis (Morton sp.) var. **ventricosa** (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 135, pl. xvii, figs. 3*a*, *b*. Mus. No. 344.

Lucina ventricosa (H. & M.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 410, pl. xi, figs. 14–16. Mus. No. 12260.

Lucina subundata (H. & M.) White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 184, pl. xviii, fig. 12*a*. Mus. No. 8644.

Lucina subundata (H. & M.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 133, pl. xvii, figs. 2, *a–e*. Mus. No. 345.

CRETACEOUS SPECIES—Continued.

Lunatia concinna (H. & M. sp.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 314, pl. xxxii, figs. 11*a–c*. Mus. No. 264.

Lunatia concinna (H. & M. sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 430, pl. xii, fig. 13. Mus. No. 12250.

Lunatia occidentalis Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 315, pl. xxxii, figs. 12*a–c*. Mus. No. 290.

Lunatia subcrassa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 316, pl. xxxix, figs. 3*a–c*. Mus. No. 265.

Mactra ? cañonensis (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 297, pl. ix, figs. 11*a–c*. Mus. No. 7844.

Mactra (Cymbophora) alta (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 210, pl. xxxvii, figs. 2*a*, *b*. Mus. Nos. 192, 2007.

Mactra (Cymbophora ?) formosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 207, pl. xxxix, fig. 7. Mus. No. 177.

Mactra (Cymbophora) nitidula (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 211, pl. xxx, figs. 6*a–c*. Mus. No. 1913.

Mactra (Cymbophora) siouxensis (M. & H.) Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 206, pl. i, figs. 7*b*, *c*. Mus. No. 207.

Mactra (Cymbophora) utahensis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 155, pl. xv, figs. 9, *a*, *b*. Mus. Nos. 7854, 12530.

Mactra ? emmonsi Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 153, pl. xv, fig. 8. Mus. No. 12525.

Mactra ? holmesi (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 295, pl. vi, figs. 5*a*, *b*, 4*a*, *b*. Mus. No. 8088.

Mactra ? incompta White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 185, pl. xvii, figs. 6*a*, *b*. Mus. No. 8636.

Mactra texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 148, pl. iv, figs. 1*a*, *b*. Mus. No. 9855.

Mactra (Trigonella ?) arenaria Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 154, pl. xiv, fig. 5. Mus. No. 7853.

Margarita mudgeana Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 300, pl. ii, fig. 9*b*. Mus. No. 7903.

Margarita nebrascensis (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 298, pl. xix, figs. 8*a*, *b*, 9*a*, *b*. Mus. Nos. 294, 415.

Margaritella flexistriata (E. & S. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 302, pl. xix, figs 11, *a–d*. Mus. No. 286.

CRETACEOUS SPECIES—Continued.

Martesia cuneata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 259, pl. xxx, figs. *8a, b*. Mus. No. 455.

Melampus sp. ? (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 25, pl. xii, fig. *6a*. Rev. non-marine Foss. Moll., p. 38 or 444, pl. v, fig. 17. Mus. No. 7890.

Melampus ? antiquus (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 23, pl. xii, figs. *11a–d*. Rev. non-marine foss. moll., p. 38 or 444, pl. v, figs. 13–16. Mus. No. 8085.

Mesalia ? kansasensis Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 333, pl. ii, figs. *7a, b*. Mus. No. 7899.

Micrabacia americana Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 1, pl. xxviii, figs. *1a, b*. Mus. No. 456.

Microstizia millepunctata Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 4, pl. xxviii, figs. *2a–c*. Mus. No. 300.

Monopleura marcida White.
Bull. U. S. Geol. Surv., No. 4, p. 96, pls. iii, iv. Mus. No. 12364.

Monopleura pinguiscula White.
Bull. U. S. Geol. Surv., No. 4, p. 96, pl. v. Mus. No. 12365.

Mortoniceras shoshonense Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 449, pl. vi, figs. *3a–c*, [6]*b*. Mus. No. 1991.

Mortoniceras ? vermilionense (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 450, pl. vii, figs. *2a, b*. Mus. No. 224.

Mytilus subarcuatus (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 69, pl. xxxviii, figs. *2a, b*. Mus. No. 354.

Natica collina Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 157, pl. xiii, figs. *2a, b*. Mus. No. 9865.

Natica texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 157, pl. xiii, figs. *1a, b*. Mus. No. 9861.

Nautilus campbelli Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 373, pl. vi, figs. 2, *a*. Mus. No. 12461.

Nautilus dekayi (Morton) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 496, pl. xxvii, figs. *1a–e*. Mus. No. 390.

Nantilus dekayi var. **montanaensis** Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 498, pl. xxvii, figs. *2a, b*. Mus. No. 392.

Nautilus dekayi var. **montanaensis** (Meek) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 439, pl. xvi, figs. 10, 11. Mus. No. 12347.

Nautilus elegans (Sowerby) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 499, pl. viii, figs. *2a–c*. Mus. No. 1912.

CRETACEOUS SPECIES—Continued.

Neæra moreauensis (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 239, pl. xvii, figs. 11*a–c*. Mus. No. 420.

Neæra moreauensis (M. & H.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 420, pl. xi, fig. 31. Mus. No. 12272.

Neæra ventricosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 238, pl. xxx, figs. 3*a–e*. Mus. No. 419.

Neithea occidentalis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 150, pl. v, figs. 1*a*, *b*. Mus. No. 9872.

Neithea texana (Rœmer) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 151 (not the figured specimen). Mus. No. 9896.

Nemodon sulcatinus (E. & S. sp.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 82, pl. xv, figs. 6*a*, *b*. Mus. No. 428.

Nerinea schottii Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 158, pl. xiv, figs. 3*a*, *b*. Mus. No. 9873.

Neritina bannisteri (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 25, pl. xii, figs. 10*a–c*. Mus. Nos. 7876, 12487.

Neritina incompta White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 308, pl. vii, figs. 6*a–c*. Mus. No. 8093.

Neritina pisiformis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 26, pl. xii, figs. 9*a–c*. Mus. No. 7884.

Neritina pisiformis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 26, pl. xii, figs. 9*a–c*. Mus. No. 7884.

Neritina pisum (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 308, pl. vii, figs. 11*a–c*. Mus. No. 7883.

Neritina (Velatella) bellatula (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 27, pl. xii, figs. 8*a*, *b*. Rev. non-Marine Foss. Moll., p. 52 or 458, pl. v, figs. 8, 9. Mus. No. 7872.

Neritina (Velatella) carditoides (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 28, pl. xii, fig. 7*a*. Rev. non-Marine Foss. Moll., p. 52 or 458, pl. v, fig. 10. Mus. No. 7873.

Neritina (Velatella) carditoides (Meek) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 189, pl. xviii, figs. 7*a–c*. Mus. No. 8632.

Neritina (Velatella) patelliformis (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 309, pl. vii, figs. 7*a–d*. Mus. Nos. 7888, 8094.

Neritina (Velatella) patelliformis var. **weberensis** (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 309, pl. vii, figs. 8*a*, *b*. Mus. No. 8092.

Nodosaria texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 159, pl. xiv, figs. 4*a–c*. Mus. No. 9887.

CRETACEOUS SPECIES—Continued.

Nucula cancellata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 102, pl. xxviii, figs. 13[*a, c*], *d, e*. Mus. Nos. 434, 1931.

Nucula obsoletistriata (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 100, pl. xv, figs. 10*a, b*. Mus. No. 351.

Nucula planimarginata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 101, pl. xv, figs. 8*a, b*; pl. xxviii, fig. 16. Mus. Nos. 437, 436.

Nucula planimarginata (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 406. pl. xi, figs. 5, 6. Mus. No. 12259.

Nucula subplana (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 352, pl. xvii, figs. 7*a, b*. Mus. No. 352.

Nuculana bisulcata (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 104, pl. xv, figs. 4*a, b*. Mus. No. 1948.

Nuculana bisulcata (Meek) Whitf.
Rep. Geol. Black Hills of Dakota, p. 407, pl. xi, fig. 7. Mus. No. 12265.

Nuculana ? equilateralis (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 106, pl. xv, figs. 7*a, b*. Mus. No. 323.

Nuculana subnasuta (H. & M.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 105, pl. xv, fig. 9. Mus. No. 305.

Odontobasis constricta (H. & M. sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 352, figs. 41, 42; p. 353. Mus. No. 1943.

Ophioderma ? bridgerensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 8, pl. xii, fig. 12*a*. Mus. No. 7820.

Ostrea (Alectryonia) bellaplicata (Shumard) White.
11th Ann Rep. U. S. Geol. & Geogr. Surv. Terr., p. 276, pl. iv, figs. 3*a, b*. Rev. Foss. Ostreidæ N. A., p. 292, pl. xlvii, figs. 1, 2. Mus. No. 12383.

Ostrea (Alectryonia) sannionis White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 277, pl. ii, figs. 2*a–e*. Rev. Foss. Ostreidæ N. A., p. 300, pl. xlv, figs. 3–7. Mus. No. 8056.

Ostrea anomioides (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 10, pl. xi, figs. 4*a, b*. Rev. Foss. Ostreidæ N. A., p. 291, pl. xxxix, figs. 4, 5. Mus. No. 7823.

Ostrea bella Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 156, pl. x, figs. 4*a, b*. Rev. Foss. Ostreidæ N. A., p. 292, pl. xxxix, fig. 6. Mus. No. 9852.

Ostrea coalvillensis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 140, pl. xv, figs. 10, *a–c*. Rev. Foss. Ostreidæ N. A., p. 293, pl. xxxvi, figs. 1–4. Mus. No. 7800.

Ostrea congesta (Conrad) Meek.
Cret. No. 3. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 13, pl. ix, figs. 1*a–e*. Rev. Foss. Ostreidæ N. A., p. 294, pl. xxxix, figs. 11–13. Mus. No. 238.

Ostrea cortex Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 157, pl. xi, figs. 4*a–d*. Rev. foss. ostreidæ N. A., p. 294, pl. xxxvii, figs. 3, 4. Mus. No. 9871.

CRETACEOUS SPECIES—Continued.

Ostrea cortex (Conrad) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 170, pl. xv, figs. 2*a–c*. Mus. No. 8642.

Ostrea (Gryphæa ?) patina (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 16, pl. x, figs. 2*a*, *b*; *a*, *b* (*bis*). Rev. Foss. Ostreidæ N. A., p. 298, pl. xlvii, figs. 5, 6. Mus. No. 325.

Ostrea (Gryphæa ?) patina var. **A** (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 18, pl. x, figs. 3*a*, *b*; pl. xi, figs. 1*a*, *b*. Rev. Foss. Ostreidæ N. A., p. 298, pl. xlvii, fig. 4. Mus. No. 325.

Ostrea (Gryphæa ?) patina var. **C** (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 18, pl. xi, figs. 4*a*, *b*. Mus. No. 325.

Ostrea (Gryphæostrea ?) subalata Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 15, pl. xxviii, fig. 5. Rev. Foss. Ostreidæ N. A., p. 300, pl. xxxix, fig. 10. Mus. No. 2101.

Ostrea inornata (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 14, pl. x, fig. 4. Mus. No. 329.

Ostrea lugubris Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 156, pl. x, figs. 5*a*, *b*. Rev. Foss. Ostreidæ N. A., p. 297, pl. xli, fig. 3. Mus. No. 9822.

Ostrea multilirata Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 157, pl. xii, figs. 1*a–d*. Rev. Foss. Ostreidæ N. A., p. 298, pl. xxxviii, figs. 1, 2. Mus. No. 9895.

Ostrea (Gryphæostrea) patina var. **B** (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 18, pl. xi, figs. 3*a*, *b*. Mus. No. 325.

Ostrea pellucida (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 15, pl. xxviii, figs. 4*a*, *b*. Rev. Foss. Ostreidæ N. A., pl. l, figs. 5, 6. Mus. No. 330.

Ostrea prudentia White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. ix, part i, p. 171, pl. xiv, figs. 2*a–d*. Rev. Foss Ostreidæ N. A., p. 299, pl. xl, figs. 5, 6. Mus. No. 8639.

Ostrea quadriplicata (Shumard) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 275, pl. v, fig. 6*a*. Rev. Foss. Ostreidæ N. A., p. 299, pl. xliii, fig. 5. Mus. No. 8077.

Ostrea robusta Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 156, pl. xi, figs. 3*a*, *b*. Rev. Foss. Ostreidæ N. A., p. 300, pl. xl, figs. 3, 4. Mus. No. 9885.

Ostrea soleniscus (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 9, pl. xi, figs. 2*a*, *b*. Rev. Foss. Ostreidæ N. A., p. 300, pl. xlii, fig. 1. Mus. No. 7780.

Ostrea subspatulata (Lyell & Sowerby) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 155, pl. x, figs. 3*a*, *b*. Mus. No. 9867.

Ostrea vellicata Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 156, pl. xi, figs. 2*a*, *b*. Mus. No. 9833.

Pachymya ? herseyi White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 298, pl. v, figs. 5*a*, *b*. Mus. No. 8091.

Pachymya ? compacta White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 22, pl. xvii, figs. 4*a*, *b*. Mus. No. 8027.

CRETACEOUS SPECIES—Continued.

Paliurus pentangulatus White.
Cret. No. 5? 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 302, pl. iv, figs. 4*a*, *b*. Mus. No. 8081.

Paramithrax ? walkeri Whitf.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 37, pl. xvi, figs. 1*a–c*; pl. xvii, fig. 1*a*. (Casts of type.) Mus. No. 8360.

Parapholas sphenoideus White.
Cret. No. 3. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 300, pl. v, figs. 1*a–d*. Mus. No. 12380.

Pharella ? pealei (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 21, pl. xi, figs. 6*a*, *b*. Mus. No. 7821.

Philloceras ? halli (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 458, pl. xxiv, figs. 3*a–c*. Mus. No. 384.

Pholadomya papyracea (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 217, pl. v, figs. 4*a*, *b*. Mus. No. 1910.

Pholadomya sancti-sabæ Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 164, pl. xxi, fig. 4. Mus. No. 9859.

Pholadomya subelongata Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 362, pl. ii, figs. 1, *a*. Mus. No. 1299.

Pholadomya subventricosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 217, pl. xxxix, figs. 8*a*, *b*. Mus. No. 181.

Pholadomya texana Conrad.
U. S. & Mex. Bound Surv., vol. i, part ii, p. 152, pl. xix, fig. 3. Mus. No. 9877.

Phylloceras ? ramosus Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 371, pl. v, figs. 1, *a*, *b*. Mus. No. 12451.

Phylloteuthis subovata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 505, pl. xxxiii, fig. 3. Mus. No. 414.

Physa ——— ? White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 307, pl. vii, fig. 13*a*. Rev. Non-Marine Foss. Moll., p. 38 or 444, pl. iv, fig. 5. Mus. No. 12384.

Physa carletoni (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 306, pl. vii, fig. 12. Rev. Non-Marine Foss. Moll., p. 43 or 449, pl. v, fig. 18. Mus. No. 7875.

Pinna petrina White.
Rep. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 182, pl. xiii, figs. 7*a*, *b*. Mus. No. 8640.

Pinna stevensoni White.
Proc. U. S. Nat. Mus., vol. iii, p. 47. Mus. No. 8101.

Placenticeras placenta var. **intercalare** (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 468, pl. xxiii, figs. 1*a–c*. Mus. No. 369.

Placenticeras (Sphenodiscus) lenticulare (Owen sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 473, pl. xxxiv, figs. 1*a–c*; fig. 66 on p. 473. Mus. No. 411.

CRETACEOUS SPECIES—Continued.

Placenticeras ? vancouverense Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 370, pl. vi, figs. 1, *a–c*. Mus. No. 1342.

Placunopsis hilliardensis White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 278, pl. vii, fig. 14*a*. Mus. No. 8082.

Plicatula hydrotheca White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 279, pl. vi, figs. 3*a*, *b*. Mus. No. 8048.

Plicatula incongrua Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 153, pl. vi, figs. 10*a*, *b*. Mus. No. 9863.

Prionocyclus woolgari (Mantel sp.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 455, pl. vii, figs. 1*a–d*, *f–h*, 3. Mus. No. 223.

Prionocyclus wyomingensis (Meek) White.
Cret. No. 3? 12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 35, pl. xv, figs. 1*a–e*. Mus. No. 7729.

Prionocyclus wyomingensis (Meek) Whitf.
Cret. No. 2. Rep. Geol. Black Hills of Dakota, p. 440, pl. xiv, figs. 1–3. Mus. No. 12283.

Protocardia (Leptocardia) subquadrata (E. & S. sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 175, pl. xxix, figs. 8*a–e*. Mus. No. 278.

Protocardia salinaensis Meek.
Cret. No. 1. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 174, pl. ii, [fig. 13*a*]. Mus. No. 7897.

Pseudobuccinum nebrascense Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 350, pl. xxxi, figs. 5*a–d*. Mus. No. 290.

Pteria linguiformis (E. & S. sp.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 32, pl. xvi, figs. 1*c*, *d*. Mus. No. 324.

Pteria linguiformis var. **subgibbosa** Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 33, pl. xxviii, fig. 12. Mus. No. 461.

Pteria linguiformis (E. & S. sp.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 384, pl. vii, fig. 2. Mus. No. 12337.

Pteria (Oxytoma ?) gastrodes (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 280, pl. x, fig. 1*a*. Mus. No. 7789.

Pteria (Oxytoma) nebrascana (E. & S.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 34, pl. xvi, fig. 3*b*. Mus. No. 425.

Pteria (Oxytoma) salinensis White.
Cret. No. 1. 12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 15, pl. xvi, figs. 2*a*, *b*. Mus. No. 8025.

Pteria parkensis White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 279, pl. iii, fig. 3*a*. Mus. No. 8074.

Pteria (Pseudopteria) fibrosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 36, pl. xvii, figs. 17*c*, *d*. Mus. No. 460.

CRETACEOUS SPECIES—Continued.

Pteria (Pseudopteria) fibrosa (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 386, pl. vii, fig. 5. Mus. No. 12332.

Pteria (Pseudopteria) propleura (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 281, pl. x, figs. 2*a*, *c*. Mus. Nos. 7788, 7790.

Pteria (Pseudopteria) sublevis Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 387, pl. vii, fig. 6. Mus. No. 12251.

Pteria ?? stabilitatis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 15, pl. xvii, fig. 3*a*. Mus. No. 8057.

Ptychoceras crassum Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 459, pl. xvi, figs. 3, 4. Mus. No. 12324.

Ptychoceras meekanum Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 457, pl. xvi, fig. 1. Mus. No. 12279.

Pyrifusus (Neptunella) intertextus Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 348, pl. xix, figs. 14*a*, *b*. Mus. No. 253.

Pyrifnsus (Neptunella) newberryi Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. Surv. Terr., 4to, vol. ix, p. 346, pl. xxxi, fig. 6*e*. Mus. No. 257*a*. Figs. 6*a–d*, *f*; fig. 39, p. 346. Mus. No. 257.

Pyrifusus (Neptunella) subturritus (M. & H. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 347, pl. xxxii, figs. 3*a*, *b*; fig. 40, p. 347. Mus. No. 254.

Pyrina parryi Hall.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 144, pl. i, figs. 1*a–d*. Mus. No. 9854.

Pyropsis bairdi (M. & H. sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 369, pl. xxxi, figs. 10*a*, *b*. Mus. No. 252

Pyropsis bairdi var. **rotula** Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 371, fig. 47. Mus. No. 252.

Requienia patagiata White.
Bull. U. S. Geol. Surv., No. 4, p. 94, pl. i, figs. 1–8; pl. ii, figs. 1–4. Mus. No. 12363.

Rostellaria ? collina Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 158, pl. xiii, figs. 4*a*, *b*. Mus. No. 9870.

Rostellaria ? texana=R. ? collina Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 157, pl. xiii, figs. 3*a*, *b*. Mus. No. 9875.

Rostellites texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 158, pl. xiv, figs. 2*a*, *b*. Mus. No. 9886.

Scaphites abyssinus (Morton sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 441, pl. xxxv, figs. 2*a*, *b*. Mus. No. 409.

Scaphites cheyennensis (Owen sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 437, pl. xxxv, figs. 3*a*, *b*. Mus. No. 402.

Scaphites conradi (Morton sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 430, pl. xxxvi, figs. 2*a–f*. Mus. Nos. 398, 400.

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CRETACEOUS SPECIES—Continued.

Scaphites conradi var. **gulosus** (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 432, pl. xxxvi, fig. 1 Mus. No. 399.

Scaphites conradi (Morton sp.) var. **intermedius** Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 433, pl. xxxiv, figs. 3*a–c*. Mus. No. 408.

Scaphites larvæformis (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 418, pl. vi, figs. 6*a–c*. Mus. No. 229.

Scaphites mandanensis (Morton sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 443, pl. xxxv, figs. 1*a–c*. Mus. No. 410.

Scaphites nicolletii (Morton sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 435, pl. xxxiv, figs. 4*a–c*, 2*a–b*. Mus. Nos. 405, 407.

Scaphites nodosus (Owen) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 441, pl. xiii, fig. 12. Mus. No. 12284.

Scaphites nodosus (Owen sp.) var. **brevis** Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 426, pl. xxv, figs. 1*a–c*. Mus. No. 367.

Scaphites nodosus var. **brevis** (Meek) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 443, pl. xiii, figs. 8, 9. Mus. No. 12289.

Scaphites nodosus var. **plenus** (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 429, pl. xxvi, figs. 1*a–c*. Mus. No. 364.

Scaphites nodosus (Owen sp.) var. **quarangularis** Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 428, pl. xxv, fig. 4. Mus. No. 365.

Scaphites nodosus (Owen) var. **quadangularis** Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 428, pl. xxv, figs. 2*a–c*, 3*a–c*. Mus. Nos. 370, 366.

Scaphites nodosus var. **quadrangularis** (Meek) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 443, pl. xiii, figs. 10, 11. Mus. No. 12291.

Scaphites vermiformis (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 423, pl. vi, figs. 4*a*, *b*. Mus. No. 1902.

Scaphites ventricosus (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 425, pl. vi, figs. 7*a*, *b*, 8*a–c*. Mus. Nos. 1903, 1904.

Scaphites warreni (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 420, pl. vi, fig. 5. Mus. No. 225.

Scaphites warreni (M. & H.) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 200, pl. xix, fig. 3*a*. Mus. No. 8636.

CRETACEOUS SPECIES—Continued.

Scaphites warreni (M. & H.) Whitf.
Rep. Geol. Black Hills Dakota, p. 444, pl. xiii, figs. 2, 3. Mus. No. 12290. Figs. 1, 4. Mus. No. 12262.

Scaphites wyomingensis (M. & H.) Whitf.
Cret. No. 2? Rep. Geol. Black Hills of Dakota, p. 446, pl. xiii, figs. 5–7. Mus. No. 12258.

Serpula tenuicarinata (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 507, pl. vi, fig. 1. Mus. No. 226.

Solemya subplicata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 129, pl. xxviii, fig. 19. Mus. No. 449.

Sphæriola? cordata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 137, pl. xxix, figs. 3*a–c*. Mus. No. 457.

Sphæriola? endotrachys Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 139, pl. xxix, fig. 2. Mus. No. 12385.

Sphæriola? obliqua Meek.
Cret. No. 5? Bull. U. S. Geol. & Geogr. Surv. Terr., 2, series, No. 1, p. 46 (not figured). Mus. No. 7835.

Sphæriola transversa Whitf.
Cret. No. 5. Rep. Geol. Black Hills of Dakota, p. 415, pl. x, figs. 14–16. Mus. No. 12316.

Sphæriola? warrenana Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 138 (not figured). Mus. No. 458.

Spironema tenuilineata (M. & H. sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 342, pl. xxxii, figs. 9*a–c*. Mus. No. 270.

Syncyclonema rigida (H. & M.) Meek.
Rep. Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 27, pl. xvi, figs. 5*a, b*. Mus. No. 347.

Syncyclonema rigida (H. & M.) Whitf.
Rep. Geol. Black Hills of Dakota, p. 383, pl. vii, fig. 1. Mus. No. 12272.

Tancredia americana (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 142, pl. xxxviii, figs. 1*b, e*. Mus. No. 186.

Tancredia? cœlionotus White.
Cret. No. 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 288, pl. v, figs. 2*a–d*. Mus. No. 8072.

Tapes hilgardi (Shumard) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 22, pl. xvi, figs. 3*b, c*. Mus. No. 8028.

Tellina?? isonema Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 156, pl. xv, fig. 6. Mus. No. 7851.

Tellina? modesta Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 157, pl. xv, fig. 5. Mus. No. 7852.

Tellina (Peronæa?) equilateralis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 196, pl. xxxix, figs. 5*a–c*. Mus. No. 179.

CRETACEOUS SPECIES—Continued.

Tellina (Peronæa ?) scitula (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 197, pl. xxx, figs. 1*a*, *b*. Mus. No. 439.

Teredo globosa (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 264, pl. xxx, fig. 13; figs. 31, 32, p. 264. Mus. No. 422.

Teredo selliformis (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 262, pl. xvii, fig. 19*d*. Mus. No. 421.

Terebratula choctawensis (Shumard) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 156. Mus. No. 9848.

Terebratula leonensis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 164, pl. xxi, fig. 2. Mus. No. 9837.

Terebratula wacoensis (Rœmer) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 147, pl. iii, figs. 1*a*–*c*. Mus. No. 9838.

Tessarolax hitzii White.
Cret. No. 4. 12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 29, pl. xv, fig. 2*a*. Mus. No. 7526.

Thetis ? circularis (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 190, pl. xvii, figs. 8*a*–*c*. Mus. No. 340.

Thetis circularis (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 417, pl. xi, figs. 22–24. Mus. No. 12330.

Thracia gracilis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 224, pl. xxxix, fig. 6*b*. Mus. No. 188.

Thracia myæformis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 23, pl. xvii, figs. 2*a*, *b*. Mus. No. 8029.

Thracia ? prouti (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 225, pl. xxxvii, figs. 6*a*, *b*. Mus. No. 189.

Thracia subgracilis Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 419, pl. xi, figs. 29, 30. Mus. No. 12253.

Thracia ? subtortuosa (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 223, pl. xxxvii, fig. 5. Mus. No. 185.

Toxaster elegans (Shumard sp.) Hall.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 146, pl. xxi, figs. 1*a*–*e*. Mus. No. 9856.

Toxaster texanus (Rœmer) Hall.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 145, pl. i, figs. 2*a*–*c*. Mus. No. 9857.

Trachytriton vinculum (H. & M. sp.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 304, pl. xix, figs. 7*a*–*d*. Mus. No. 261.

Trapezium ? micronema (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 293, pl. x, fig. 5*a*. Mus. No. 7846.

Trapezium truncatum (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 292, pl. x, figs. 6*a*, *b*. Mus. No. 7813.

CRETACEOUS SPECIES—Continued.

Trigonarca (Breviarca) exigua (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 93, pl. xv, figs. *2a–f*. Mus. No. 348.

Trigonia emoryi Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 148, pl. iii, figs. *2a–c*. Mus. No. 9849.

Trigonia evansi Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, p. 359, pl. ii, fig. 7. Mus. No. 12452.

Trigonia texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 148, pl. iii, figs. *3a–c*. Mus. No. 9843.

Turbinolia texana Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 144, pl. ii, figs. *3a, b*. Mus. No. 9836.

Turbonilla (Chemnitzia) coalvillensis (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 305, pl. ix, figs. *5a, b*. Mus. No. 7880.

Turbonilla (Chemnitzia) melanopsis (Conrad ?) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 197, pl. xviii, fig. *10a*. Mus. No. 8655.

Turnus (Goniochasma) stimpsoni (M. & H.) Meek.
Cret. No. 4. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to., vol. ix, p. 256, pl. xxx, figs. *9a, b*. Mus. No. 451.

Turris (Surcula ?) contortus Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 385, fig. 49; pl. xxxi, figs. *7a–c*.

Turris (Surcula ?) hitzi Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 386, fig. 50, p. 387. Mus. No. 12458.

Turritella coalvillensis (Meek) White.
Cret. No. 4 or 5. 11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 315, pl. ix, fig. *4a*. Mus. No. 7878.

Turritella leonensis Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 165, pl. xxi, figs. *7a, b*. Mus. No. 9834.

Turritella marnochi White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 315, pl. vii, figs. *5a, b*. Mus. No. 8055.

Turritella (Aclis ?) micronema (Meek) White.
11th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 316, pl. ix, fig. *8a*. Mus. No. 7882.

Turritella planilateris Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 158, pl. xiv, figs. 1, *a, b*. Mus. No. 9845.

Turritella spironema (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 31, pl. xii, fig. *3a*. Mus. No.. 7870.

Turritella uvasana (Conrad) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 195, pl. xviii, figs. *11a, b*. Mus. No. 8657.

Tylostoma princeps White.
Proc. U. S. Nat. Mus., vol. iii, p. 140, pl. ii, figs. 1, 2. Mus. No. 8864.

CRETACEOUS SPECIES—Continued.

Uintacrinus socialis (Grinnel) Meek.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. ii, No. 4, pp. 375–378, figs. A, B, on p. 375. Mus. No. 8044.

Valvata nana (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 33, pl. xii, figs. 17*a*, *b*. Rev. Non-Marine Foss. Moll., p. 64 or 470, pl. v, figs. 19, 20. Mus. No. 8093.

Vanikoro ambigua Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 330, pl. xix, figs. 12*a–d*. Mus. No. 267.

Vanikoropsis tuomeyana M. & H.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 332, pl. xxxix, figs. 2*a*, *b*. Mus. No. 266.

Veniella goniophora Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 152, pl. iv, fig. 4; fig. 12 on p. 152. Mus. No. 1720.

Veniella goniophora (Meek) White.
Rep. U. S. Geogr. & Geol. Expl. & Surv. west of 100th Meridian, vol. iv, part i, p. 185 (not figured). Mus. No. 8550.

Veniella humilis (M. & H.) Whitf.
Cret. No. 5. Rep. Geol. Black Hills of Dakota, p. 414, pl. x, figs. 8–12. Mus. No. 12333.

Veniella mortoni (M. & H.) Meek.
Cret. No. 2. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 154, pl. iv, figs. 3*a*, *b*. Mus. No. 2037.

Veniella subtumida (M. & H.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 154, pl. xvii, figs. 5*a*, *b*. Mus. No. 361.

Veniella (Venilicardia?) humilis (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 155, pl. xxx, figs. 5*a–c*. Mus. No. 444.

Volsella attenuata (M. & H.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 74, pl. xxviii, figs. 8*a*, *b*. Mus. No. 486.

Volsella (Brachydontes) multilinigera (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 18, pl. xi, [fig. 3*a*]. Mus. No. 7781.

Volsella galpiniana (E. & S. sp.) Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 73, pl. xxviii, figs. 7*a*, *b*. Mus. No. 446.

Volsella meekii (E. & S. sp.) Meek.
Cret. Nos. 4, 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 72, pl. xv, figs. 3*a–c*. Mus. No. 313.

Websteria cretacea Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 3, [pl. xxviii, figs. 3*a–c*]. Mus. Nos. 333, 416.

Yoldia evansi (M. & H.) Whitf.
Cret. No. 4. Rep. Geol. Black Hills of Dakota, p. 409, pl. xi, fig. 1. Mus. No. 12340.

Yoldia scitula Meek.
Cret. No. 5. Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 110, pl. xxviii, fig. 9. Mus. No. 302.

LARAMIE SPECIES.

Acroloxus minutus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 543, pl. xliv, fig. 10. Rev. Non-Marine Foss. Moll., p. 45, or 451, pl. xxiv, fig. 27. Mus. No. 3126.

Anodonta parallela White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 62, pl. xxiv, fig. 3*a*. Rev. Non-Marine Foss. Moll., p. 23 or 429, pl. xix, fig. 5. Mus. No. 9028.

Anodonta propatoris White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 61, pl. xxiv, figs. 2*a–d*. Rev. Non-Marine Foss. Moll., p. 23 or 429, pl. xix, figs. 6–9. Mus. No. 13406

Anomia micronema (Meek) White.
Rev. Non-Marine Foss. Moll., p. 16 or 442, pl. xii, figs. 7, 9, 11. Mus. Nos. 12492, 9931.

Anomia micronema (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 57, pl. xxv, figs. 2*a–d*. Rev. Non-Marine Foss. Moll., p. 16 or 442, pl. xii, figs. 6, 8, 10. Mus. No. 9038.

Axinea holmesiana White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 59, pl. xx, figs. 2*a*, *b*. Mus. No. 9055.

Bulinus atavus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 86, pl. xxiv, figs. 5*a*, *b*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxv, figs. 6, 7. Mus. No. 12481.

Bulinus disjunctus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 86, pl. xxiv, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 45 or 451, pl. xxv, figs. 4, 5. Mus. No. 12469.

Bulinus longiusculus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 541, [pl. xliii, figs. 16*a*, *b*]. Rev. Non-Marine Noss. Moll., p. 45 or 451, [pl. xxv, fig. 8]. Mus. No. 2120.

Bulinus subelongatus M. & H.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 540, pl. xlii, figs. 13*a*, *b*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxv, figs. 10, 11. Mus. No. 2118.

Campeloma macrospira (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 102, pl. xxx, fig. 2*a*. Rev. Non-Marine Foss. Moll., p. 63 or 469, pl. viii, figs. 6, 7. Mus. No. 7619.

Campeloma multilineata (M. & H.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 101, pl. xxviii, figs. 4*a*, *b*. Rev. Non-Marine Foss. Moll., p. 63 or 469, pl. xxvii, figs. 1, 7. Mus. No. 9029.

Campeloma multilineata White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 63, pl. xxvii, figs. 2–4, 6. Mus. No. 8139.

Campeloma producta White.
Rev. Non-Marine Foss. Moll., p. 63 or 469, pl. xxvi, figs. [25], 26. Mus. No. 8140.

Campeloma producta White.
Rev. Non-Marine Foss. Moll., p. 63, pl. xxvi, figs. 21–24, 27. Mus. No. 8140.

Campeloma vetula (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 587, pl. xlii, figs. 14*a*, *b*. Rev. Non-Marine Foss. Moll., p. 63 or 469, pl. xxvii, figs. 8, 9. Mus. No. 2153

Cassiopella turricula White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 97, pl. xxvii, figs. 3*a–d*, *f–g*. Rev. Non-Marine Foss. Moll., p. 58 or 464, pl. xxiii, figs. 25–29. Mus. No. 9058.

LARAMIE SPECIES—Continued.

Columna teres (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 555, pl. xliv, figs. 11*a*, *b*. Rev. Non-Marine Foss. Moll., p. 48 or 454, pl. xxv, fig. 15. Mus. No. 2115.

Columna vermicula (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 556, pl. xliv, figs. 12, *a*, *b*. Rev. Non-Marine Foss. Moll., p. 48 or 454, pl. xxv, fig. 16. Mus. No. 2114.

Columna vermicula (M. & H.) var. **contraria** Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 557 (unfigured). Mus. No. 2114.

Corbicula angheyi White.
Rev. Non-Marine Foss. Moll., p. 32 or 438, pl. xxi, figs. 4–6. Mus. No. 11557.

Corbicula [bannisteri Meek] occidentalis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 75, pl. xxi, figs. 3*b*, *c*. Mus. No. 7834.

Corbicula berthoudi White.
Rev. Non-Marine Foss. Moll., p. 32 or 438, pl. xxi, figs. 1–3. Mus. No. 11556.

Corbicula cleburni White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 73, pl. xxiii, figs. 1*a*–*c*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xx., figs. 7–9. Mus. No. 9023.

Corbicula cytheriformis (M. & H.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 74, pl. xxi, figs. 4*a*–*d*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxii, figs. 3–6. Mus. Nos. 8117, 9673.

Corbicula cytheriformis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 520, pl. xl, figs. 5*a*–*e*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxii, figs. 1, 2. Mus. No. 2133.

Corbicula (Leptesthes) cardiniæformis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 73, pl. xxv, figs. 5*a*, *b*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxii, figs. 10, 11. Mus. No. 9024.

Corbicula (Leptesthes) cardiniæformis White.
Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxii, figs. 12–15. Mus. No. 12477.

Corbicula (Leptesthes) fracta (Meek) White.
Rev. Non-Marine Foss. Moll., p. 33 or 439, pl. xx, figs. 2–6. Mus. No. 8104.

Corbicula (Leptesthes) macropistha White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 78, pl. xxiii, figs. 4*a*–*f*. Rev. Non-marine Foss. Moll., p. 31 or 437, pl. xxi, figs. 11–14. Mus. No. 8124.

Corbicula (Leptesthes) planumbona (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 77, pl. xxi, figs. 2*a*–*d*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxii, figs. 7–9. Mus. No. 8126.

Corbicula (Leptesthes) subelliptica (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 523, pl. xliii, figs. 9*b*, *c*. Mus. No. 12473.

Corbicula nebrascensis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 522, pl. xliii, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xx, figs. 12, 13. Mus. No. 2131.

Corbicula obesa White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 72, pl. xxiii, figs. 3*a*–*e*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxiii, figs. 7–11. Mus. No. 9025.

Corbicula occidentalis (M. & H.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 75, pl. xxi, fig. 3*a*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xxiii, figs. 1–6. Mus. Nos. 8112, 8113.

LARAMIE SPECIES—Continued.

Corbicula subelliptica (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 523, pl. xliii, fig. 9*a*. Mus. No. 441.

Corbicula subelliptica (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. xx, figs. 10, 11. Mus. No. 8123.

Corbicula subelliptica var. **moreauensis** (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 524, pl. xliii, figs. 1*a–c*. Mus. No. 2132.

Corbicula umbonella (Meek) White.
Rev. Non-Marine Foss. Moll., p. 32 or 438, pl. xxi, figs. 7, 8. Mus. No. 12468.

Corbicula (**Veloritina**) **durkeei** Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 167, pl. xvi, figs. 6, *a*, *c*, *d*. Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. viii, figs. 10, 11. Mus. No. 7621.

Corbicula (**Veloritina**) **durkeei** (Meek) White.
Rev. Non-Marine Foss. Moll., p. 31 or 437, pl. viii, fig. 9. Mus. No. 8148.

Corbicula (**Veloritina**) **durkeei** (Meek sp.) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 207, pl. xxi, figs. 13*a*, *b*. Mus. No. 8613

Corbula (**Anisorhyncus**) **pyriformis** Meek.
Rep. Expl. Great Basin of Utah, by Capt. J. H. Simpson, p. 361, pl. v, figs. 9, 10. Mus. No. 493.

Corbula (**Potamomya**) **concentrica** Meek.=**Corbula** (**Anisorhyncus**) **pyriformis** Meek.
Proc. Acad. Nat. Sci. Philad., 1860, vol. xii, p. 312. Mus. No. 494.

Corbula engelmanni Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 174, pl. xvii, fig. 1*a*. Mus. No. 495.

Corbula mactriformis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 528, pl. xliii, figs. 7*a*–[*f*]. Rev. Non-Marine Foss. Moll., p. 36 or 442, pl. xviii, figs. 12–15. Mus. No. 2168.

Corbula perundata (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 530, pl. xl, fig. 4*c*. Mus. No. 2181.

Corbula pyriformis (Meek) White.
Rev. Non-Marine Foss. Moll., p. 35 or 441, pl. viii, figs. 12–16. Mus. No. 8149.

Corbula subtrigonalis (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 36 or 442, pl. xix, fig. 10. Mus. No. 8109. (N. B.—Fig. 15 is example of *C. trepidophora* Meek.)

Corbula subtrigonalis (M. & H.) White.
12 Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 80, pl. xxv, figs. 6*a–c*. Rev. Non-Marine Foss. Moll., p. 36 or 442, pl. xix, figs. 11–13. Mus. No. 8107.

Corbula (**Tropidophora** Meek) **subtrigonalis** (M. & H.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 80, pl. xxv, fig. 6*f*. Rev. Non-Marine Foss. Moll., p. 36 or 442, pl. xix, fig. 15. Mus. No. 8109.

Corbula undifera (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 80, pl. xxix, figs. 4*a–f*. Rev. Non-Marine Foss. Moll., p. 36 or 442, pl. xviii, figs. 6–9. Mus. No. 9060.

Corbula undifera (Meek) var. **subundifera** White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 81, pl. xxix, figs. 5*a–c*. Rev. Non-Marine Foss. Moll., p. 36 or 442, pl. xviii, figs. 10, 11. Mus. No. 9056.

Cypris ——— ? White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 216 (not figured). Mus. No. 8592.

LARAMIE SPECIES—Continued.

Goniobasis chrysalis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 91, pl. xxx, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 56 or 462, pl. vi, figs. 13, 14. Mus. No. 8153.

Goniobasis chrysalloidea White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 92, pl. xxx, figs. 5*a*, *b*. Rev. Non-Marine Foss. Moll., p. 56 or 462, pl. vi, figs. 10, 11. Mus. No. 8157.

Goniobasis cleburni White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 91, pl. xxx, figs. 4*a*–*d*. Rev. Non-Marine Foss. Moll., p. 56 or 462, pl. vi, figs. 7–9. Mus. No. 8152.

Goniobasis convexa Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 562, pl. xlii, figs. 2*a*, *b*; fig. 71, p. 562. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, figs. 6, 7 Mus. No. 2142.

Goniobasis convexa var. **impressa** (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 563, pl. xlii, figs. 2*c*, *d*. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, figs. 8, 9. Mus. No. 2143.

Goniobasis endlichi White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 92, pl. xxx, figs. 7*a*–*c*. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. vii, figs. 7–9. Mus. No. 8161.

Goniobasis gracilenta Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 568, pl. xlii, fig. 3; p. 569, fig. 74. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, fig. 12. Mus. No. 12482.

Goniobasis gracilenta (Meek) White.
Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, fig. 13. Mus. No. 8203.

Goniobasis invenusta (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 564, pl. xlii, figs. 1*b*, [1*a*, *d*, *e*]. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, fig. 17. Mus. No. 2144.

Goniobasis nebrascensis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 565, [pl. xliii, figs. 12*a*, *h*]. Rev. Non-Marine Foss. Moll., p. 57 or 463, [pl. xxvi, figs. 15–16]. Mus. No. 2138.

Goniobasis nebrascensis (M. & H.) White.
Rep. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 213, pl. xxi, figs. 9, *b*, *c*. Mus. No. 8602.

Goniobasis omitta (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 568, pl. xlii, figs. 4*a*–*c*. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, fig. 10. Mus. No. 2184.

Goniobasis sublævis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 567, pl. xlii, figs. 5*a*, *b*. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, fig. 18. Mus. No. 2145.

Goniobasis tenuicarinata (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 566, pl. xliii, figs. 14*a*–*c*. Rev. Non-Marine Foss. Moll., p. 57 or 463, pl. xxvi, fig. 11. Mus. No. 2141.

Goniobasis tenuicarinata (M. & H.) White.
Rep. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 212, pl. xxi, figs. 10*a*, *b*. Mus. No. 8597.

Helix evanstonensis White.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. iv, p. 714. Rev. Non-Marine Foss. Moll., p. 48 or 454, pl. xxvii, figs. 29–31. Mus. No. 12502.

LARAMIE SPECIES—Continued.

Helix kanabensis White.
Rep. Geol. Eastern Uinta Mts., J. W. Powell, p. 120. Rev. Non-Marine Foss. Moll., p. 48 or 454, pl. xxv, figs. 12-14. Mus. No. 8883.

Helix (Patula) sepulta White.
Proc. U. S. Nat. Mus., vol. iii, p. 160. Rev. Non-Marine Foss. Moll., p. 48 or 454. Mus. No. 8908.

Helix ? vetusta (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 552, pl. xlii, figs. 7*a*, *b*. Rev. Non-Marine Foss. Moll., p. 48 or 454, pl. xxvii, fig. 28. Mus. No. 2104.

Hyalina ? occidentalis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 547, pl. xlii, figs. 6*a–d*. Rev. Non-Marine Foss. Moll., p. 46 or 470, pl. xxvii, fig. 27. Mus. No. 2106.

Hydrobia anthonyi (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 571, pl. xliii, figs. 10*a–c*. Rev. Non-Marine Foss. Moll., p. 59 or 465, pl. xxvii, fig. 39. Mus. No. 2149.

Hydrobia recta White.
Rep. Geol. Eastern Uinta Mts., J. W. Powell, p. 132. Rev. Non-Marine Foss. Moll., p. 60 or 466, pl. xxvii, fig. 38. Mus. No. 12501.

Hydrobia utahensis White.
Rep. Geol. Eastern Uinta Mts., J. W. Powell, p. 132. Rev. Non-Marine Foss. Moll., p. 60 or 466, pl. xxvii, fig. 35. Mus. No. 8870.

Hydrobia warrenana (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 572, pl. xliii, figs. 11*a–c*. Rev. Non-Marine Foss. Moll., p. 59 or 465, pl. xxvii, fig. 40. Mus. No. 2147.

Limnæa (Acella) haldemania White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 84, pl. xxx, figs. 9*a*, *b*. Rev. Non-Marine Foss. Moll., p. 39 or 445, pl. vi, figs. 18, 19. Mus. No. 8163.

Limnæa ? compactilis (Meek) White.
Rev. Non-Marine Foss. Moll., p. 39 or 445, pl. xxvi, fig. 14. Mus. No. 8207.

Limnæa (Limnophysa) nitidula Meek.
Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 363, pl. v, fig. 14. Rev. Non-Marine Foss. Moll., p. 39 or 445, pl. vi, figs. 15, 16. Mus. No. 685.

Limnæa (Pleurolimnæa) tenuicostata (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 534, pl. xliv, figs. 13*a–c*. Rev. Non-Marine Foss. Moll., p. 39 or 445, pl. xxiii, fig. 24. Mus. No. 12488.

Melanopsis ? americana White.
Rev. Non-Marine Foss. Moll., p. 55 or 461, pl. xxiii, figs. 21-23. Mus. Nos. 11559, 12495.

Melania insculpta (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 94, pl. xx, fig. 4*a*. Mus. No. 8197.

Melania insculpta (Meek) White.
Rev. Non-Marine Foss. Moll., p. 54 or 460, pl. xxvi, figs. 4, 5. Mus. No. 12490.

Melania wyomingensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 95, pl. xxviii, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 54 or 460, pl. xxvi, fig. 2. Mus. No. 9018.

Melania wyomingensis (Meek) White.
Rev. Non-Marine Foss. Moll., p. 54 or 460, pl. xxvi, fig. 3. Mus. No. 12491.

Melania wyomingensis Meek.
Ann. Rep. U. S. Geol. & Geogr. Surv. Terr. for 1872, p. 516 (not figured specimens.) Mus. No. 7833.

LARAMIE SPECIES—Continued.

Micropyrgus minutulus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 575, pl. xliii, figs. 18*a*, *b*. Rev. Non-Marine Foss. Moll., p. 59 or 465, pl. xxvi, fig. 20. Mus. No. 2137.

Neritina bruneri White.
Rev. Non-Marine Foss. Moll., p. 53 or 459, pl. xxiii, figs. 14, 15. Mus. No. 11558.

Neritina naticiformis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 89, pl. xxx, figs. 3*a*, *b*. Rev. Non-Marine Foss. Moll., p. 52 or 458, pl. vii, figs. 5, 6. Mus. No. 12485.

Neritina (Velatella) baptista White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Rerr., p. 89, pl. xxix, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 52 or 458, pl. xxiii, figs. 16, 17. Mus. No. 12504.

Neritina volvilineata White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 88, pl. xxi, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 52 or 458, pl. xxiii, figs. 12, 13. Mus. No. 8198.

Nuculana inclara White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 60, pl. xxv, fig. 7*a*. Mus. No. 8122.

Odontobasis buccinoides White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 102, pl. xx, figs. 3*a*, *b*. Mus. No. 9045.

Odontobasis ? formosa White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 103, pl. xxviii, fig. 7*a*. Mus. No. 9046.

Ostrea arcuatilis (Meek), **glabra** (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. x, fig. 5. Rev. Foss. Ostreidæ N. A., p. 308, pl. lix, fig. 5. Mus. No. 7839.

Ostrea glabra (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 509, pl. xl, figs. 2*a*–*d*. Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. ix, figs. 1, 2. Rev. Foss. Ostreidæ N. A., p. 307, pl. lviii, figs. 1, 2. Mus. No. 2165.

Ostrea glabra (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. ix, figs. 3, 4; pl. x, figs. 1, 2. Rev. Foss. Ostreidæ N. A., p. 307, pl. lviii, figs. 3, 4; pl. lix, figs. 1, 2. Mus. No. 13407.

Ostrea glabra (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. xi, figs. 1, 2. Rev. Foss. Ostreidæ N. A., pl. lx, figs. 1, 2. Mus. No. 12472.

Ostrea insecuris White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 56, pl. xxi, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. x, figs. 3, 4. Rev. Foss. Ostreidæ N. A., p. 308, pl. lix, figs. 3, 4. Mus. No. 9053.

Ostrea subtrigonalis (E. & S.) White.
Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. xii, figs. 2–5. Rev. Foss. Ostreidæ N. A., p. 308, pl. lxi, figs. 4–7. Mus. No. 8386.

Ostrea subtrigonalis ? (E. & S.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 510, pl. xl, figs, 1*a*–*d*. Mus. No. 2172.

Ostrea (**wyomingensis** Meek) **glabra** White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 56, pl. xx, figs. 1*a*–*c*. Rev. Non-Marine Foss. Moll., p. 15 or 421, pl. xi, figs. 3, 4; pl. xii, fig. 1. Rev. Foss. Ostreidæ N. A., p. 307, pl. lx, figs. 3, 4; pl. lxi, fig. 1. Mus. No. 9062.

LARAMIE SPECIES—Continued.

Physa ——? White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 85, pl. xxx, fig. 11. Rev. Non-Marine Foss. Moll., p. 43 or 449, pl. vi, fig. 17. Mus. No. 12484.

Physa copei White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 85, pl. xxiv, figs. 4*a*, *b*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxv, figs. 1, 2. Mus. No. 12470.

Physa felix White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 84, pl. xxii, fig. 1*a*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxv, fig. 3. Mus. No. 9054.

Pisidium saginatum White.
Rep. Geol. Eastern Uinta Mts., J. W. Powell, p. 128. Rev. Non-Marine Foss. Moll., p. 34 or 440, [pl. xx, figs. 14, 15]. Mus. No. 8208.

Planorbis ——? White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 210 (not figured). Mus. No. 8595.

Planorbis æqualis White.
Proc. U. S. Mat. Mus., vol. iii, p. 159. Rev. Non-Marine Foss. Moll., p. 42 or 448, pl. xxix, fig. 10. Mus. No. 8909.

Planorbis (Bathyomphalus) amplexus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 539 (not the figured specimen). Mus. No. 2105.

Planorbis (Bathyomphalus) kanabensis White.
Rep. Geol. Eastern Uinta Mts., J. W. Powell, p. 119. Rev. Non-Marine Foss. Moll., p. 41 or 447, pl. xxvii, figs. 21–23. Mus. No. 12506.

Planorbis (Bathyomphalus) planoconvexus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 538, pl. xliv, figs. 9*a*–*c*. Rev. Non-Marine Foss. Moll., p. 41 or 447, pl. xxvii, figs. 17, 18. Mus. No. 2182.

Planorbis convolutus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 536, pl. xlii, figs. 12*a*, *b*. Mus. No. 2167.

Planorbis convolutus (M. & H.) var. Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 538, pl. xlii, figs. 11*a*–*e*. Rev. Non-Marine Foss. Moll., p. 41 or 447, pl. xxvii, fig. 16. Mus. No. 2176.

Pyrgulifera humerosa Meek.
Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 363, pl. v, figs. 6*a*–*c*. Mus. No. 498.

Pyrgulifera humerosa Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 176, pl. xvii, fig. 19; fig. 6 on p. 177. Rev. Non-Marine Foss. Moll., p. 54 or 460, pl. vi, figs. 4, 5. Mus. Nos. 12470, 12499.

Rhytophorus meekii White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 82, pl. xxx, figs. 8*a*, *b*. Rev. Non-Marine Foss. Moll., p. 38 or 444, pl. viii, figs. 4, 5. Mus. No. 8159.

Rhytophorus priscus Meek.
Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 364, pl. v, figs. 4*a*, *b*. Rev. Non-Marine Foss. Moll., p. 38 or 444, pl. viii, figs. 2, 3. Mus. No. 500.

Sphærium ——? White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 208 (not figured). Mus. No. 8593.

Sphærium formosum (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 526 (not the figured specimen). Mus. No. 2125.

LARAMIE SPECIES—Continued.

Sphærium planum (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 526, [pl. xliii, figs. 6*a*, *b*]. Rev. Non-Marine Foss. Moll., p. 33 or 439, [pl. xvii, fig. 8]. Mus. No. 2130.

Sphærium recticardinale (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 527, [pl. xliii, figs. 3*a*, *b*]. Rev. Non-Marine Foss. Moll., p. 33 or 439, [pl. xvii, fig. 9]. Mus. No. 2129.

Thaumastus limnæiformis (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 553, [pl. xliv, figs. 8, *a–d*]. Mus. No. 2111.

Tulotoma thompsoni White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 100, pl. xxviii, fig. 2*e*? Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, fig. 17. Mus. No. 9026.

Tulotoma thompsoni White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 100, pl. xxviii, figs. 2*a–h*. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv figs. 17–22. Mus. No. 9026.

Unio aldrichi White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 62, pl. xxix, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xv, figs. 4, 5. Mus. No. 9042.

Unio belliplicatus (Meek) White.
Rev. Non-Marine Foss. Moll., p. 24 or 430, pl. vi, fig. 1. Mus. No. 8146.

Unio belliplicatus var. Meek.
(Indicated as varieties by F. B. Meek, but not published.)

Unio brachyopisthus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 64, pl. xxii, figs. 2*a*, *b*. Mus. No. 9051.

Unio couesii White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 64, pl. xxvii, fig. 1*a*. Rev. Non-Marine Foss. Moll., p. 26 or 432, pl. xvi, fig. 1. Mus. No. 9033.

Unio cryptorhynchus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 68, pl. xxiv, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 25 or 431, pl. xiv, fig. 6. Mus. No. 12503.

Unio cryptorhynchus White.
Rev. Non-Marine Foss. Moll., p. 25 or 431, pl. xiv, fig. 7. Mus. No. 12483.

Unio danæ (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 517, pl. xli, figs. 3*a–c*. Mus. No. 2163.

Unio danæ (M. & H.) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 68, pl. xxvii, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xviii, figs. 1, 2. Mus. No. 9021.

Unio deweyanus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 519, pl. xli, figs. 2*a–c*. Rev. Non-Marine Foss. Moll., p. 25 or 431, pl. xvii, figs. 4, 5. Mus. No. 2175.

Unio endlichi White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 66, pl. xxvi, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 26 or 432, pl. xv, figs. 1, 2. Mus. No. 9022.

Unio goniambonatus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 63, pl. xxix, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xix, figs. 3, 4. Mus. No. 9043.

Unio gonionotus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 71, pl. xxvi, figs. 2*a*, *c–e*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xiii, figs. 7, 9, 10. Mus. No. 9035.

LARAMIE SPECIES—Continued.

Unio holmesianus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 67, pl. xxii, figs. 4*a–e*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xvi, figs. 2–6. Mus. No. 9041.

Unio mendax White.
Bull. U. S. Geol. & Geogr. Surv. Terr., vol. iii, p. 605. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xviii, figs. 3–5. Mus. No. 8873.

Unio primærus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 70, pl. xxix, fig. 3*b*. Rev. Non-Marine Foss. Moll., p. 26 or 432, pl. xiv, figs. 4, 5. Mus. No. 12474.

Unio priscus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 516, pl. xliii, fig. 8*d*. Rev. Non-Marine Foss. Moll., p. 26 or 432, pl. xiv, fig. 1. Mus. No. 2162.

Unio proavitus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 65, pl. xxii, figs. 3*a–d*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xiii, figs. 3–6. Mus. No. 9036.

Unio propheticus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 65, pl. xxii, fig. 5*a*. Rev. Non-Marine Foss. Moll., p. 27 or 433, pl. xv, fig. 3. Mus. No. 9052.

Unio senectus White.
12th Ann. Rep. U. S. Oeol. & Geogr. Surv. Terr., p. 69, pl. xxviii, figs. 1*a–c*. Rev. Non-Marine Foss. Moll., p. 26 or 432, pl. xix, figs. 1, 2. Mus. No. 8141.

Unio subspatulatus Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 518, pl. xli, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 25 or 431, pl. xiv, figs. 2, 3. Mus. No. 2164.

Unio vetustus Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 164, pl. xvi, figs. 5*a*, *b*. Rev. Non-Marine Foss. Moll., p. 24 or 430, pl. vii, fig. 1. Mus. No. 7764.

Unio vetustus (Meek) White.
Rev. Non-Marine Foss. Moll., p. 24 or 430, pl. vii, fig. 4. Mus. No. 8147.

Unio vetustus Meek.
Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 361, pl. v, figs. 12*a*, *b*. Mus. No. 492.

* **Unio vetustus** (Meek) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, p. 206, pl. xxi, figs. 12*a–d*. Mus. No. 8591.

Valvata ? montanaensis Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 591, figs. 81–83 on p. 591. Rev. Non-Marine Foss. Moll., p. 64 or 470, pl. xxvii, fig. 24. Mus. No. 2177. *r*.

Vitrina obliqua (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 545, pl. xlii, figs. 10*a*, *b*. Rev. Non-Marine Foss. Moll., p. 46 or 452, pl. xxvii, figs. 32, 33. Mus. No. 2108.

Viviparus ——— ? White.
Rep. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 215, pl. xxi, figs. 7*a*, *b*. Mus. No. 8609.

Viviparus conradi (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 579, pl. xlii, figs. 15*c*, *d*. Mus. No. 2156.

Viviparus conradi (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, figs. 4–6. Mus. No. 2156.

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* A mistake; this is really *Unio mendax* White.

LARAMIE SPECIES—Continued.

Viviparus couesii White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 99, pl. xxx, fig. 1*a*. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. viii, fig. 1. Mus. No. 8151.

Viviparus ionicus White.
Rep. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 215, pl. xxi, figs. 7*a*, *b*. Mus. No. 8608.

Viviparus leai (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 577, pl. xliv, figs. 6*a–c*. Mus. No. 2154.

Viviparus leai (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxvii, figs. 10–14. Mus. Nos. 8142, 12480.

Viviparus leidyi (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 582, pl. xliv, fig. 4. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, fig. 7. Mus. No. 12489.

Viviparus leidyi var. **formosus** (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 583, pl. xliv, figs. 3*a–c*. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, figs. 8, 9. Mus. No. 2159.

Viviparus panguitchensis White.
Rep. Geol. Uinta Mts., J. W. Powell, p. 123. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxv, figs. 19–21. Mus. No. 8145.

Viviparus plicapressus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 98, pl. xxviii, figs. 3*a*, *b*. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, figs. 25, 26. Mus. No. 8199.

Viviparus prudentius White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 98, pl. xxviii, figs. 5*a*, *b*. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxv, figs. 17, 18. Mus. No. 9031.

Viviparus raynoldsianus Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 584, pl. xliv, figs. 7*a*, *b*. Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxv, figs. 22, 23. Mus. No. 1970.

Viviparus retusus (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, figs. 1–3. Mus. No. 8143.

Viviparus trochiformis (M. & H.) White.
Rev. Non-Marine Foss. Moll., p. 61 or 467, pl. xxiv, figs. 10–16. Mus. No. 8144.

Viviparus trochiformis (M. & H.) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 214, pl. xxi, figs. 4*a–c*. Mus. No. 8601.

Viviparus trochiformis (M. & H.) var. White.
Rep. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 215, pl. xxi, figs. 5*a*, *b*. Mus. No. 8598.

Volsella (Brachydontes) laticostata White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 59, pl. xxv, fig. 4*a*. Rev. Non-Marine Foss. Moll., p. 17 or 423, pl. xiii, fig. 2. Mus. No. 8121.

Volsella (Brachydontes) regularis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., pp. 58, 59, pl, xxv, fig. 3*a*. Rev. Non-Marine Foss. Moll., p. 17 or 423, pl. xiii, fig. 1. Mus. No. 9044.

EOCENE SPECIES.

Busycon ? blakei Conrad.
Rep. Expls. & Survs. Mississippi River to the Pacific Ocean, vol. v, p. 322, pl. ii, fig. 13. Mus. No. 1863.

Bythinella gregaria Meek.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 48, pl. xix, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 60 or 466, pl. xxviii, figs. 12, 13. Mus. No. 7836.

Cardita planicosta (Lamarck) Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 161, pl. xix, fig. 2. Mus. No. 9900.

***Cardita planicosta** (Lamarck) Conrad.
Rep. Expls. & Survs. Mississippi River to the Pacific Ocean, vol. v, p. 321. Mus. No. 1837.

Cardium linteum Conrad.
Rep. Expls. & Survs. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 320, pl. ii, fig. 1. Mus. No. 1834.

Corbicula powelli White.
Rep. Geol. of Eastern Uinta Mts., J. W. Powell, p. 127. Mus. No. 12508.

Crassatella alta Conrad.
Rep. Expls. Survs. Mississippi River to the Pacific Ocean, vol. v, p. 321 (not figured). Mus. No. 1838.

Crassatella declivis Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 151, pl. —, fig. 9. Mus. No. 2490.

Cytherea nuttali Conrad.
Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 162, pl. iv, fig. 5. Mus. No. 9905.

Dosinia alta Conrad.
Rep. Expls. & Survs. Mississippi River to the Pacific Ocean, vol. v, p. 320, pl. ii, fig. 2. Mus. No. 1835.

Eucheilodon creno-carinata Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 150, pl. —, fig. 4. Mus. No. 8921.

Fusus marnochi Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 151, pl. —, fig. 6. Mus. No. 8917.

Goniobasis tenera (Hall) White.
Rep. U. S. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 212, [pl. xxi, figs. 11*a*–*c*]. Mus. No. 8603.

Goniobasis tenera (Hall) White.
Rev. Non-Marine Foss. Moll., p. 58, pl. xxxi, figs. 1–30. Mus. No. 8887.

Goniobasis simpsoni Meek.
Rep. Expls. Great Basin of Utah, J. H. Simpson, p. 365, pl. v, fig. 1*e*. Rev. Non-Marine Foss. Moll., p. 58 or 464, pl. xxxi, fig. 2. Mus. No. 691.

Helix peripheria White.
Rep. Geol. Eastern Uinta Mts., J. W. Powell, p. 130. Rev. Non-Marine Foss. Moll., p. 49 or 455, pl. xxix, figs. 11, 12. Mus. No. 8882.

Helix riparia White.
Rep. Geol. of Eastern Uinta Mts., J. W. Powell, p. 130. Rev. Non-Marine Foss. Moll., p. 49 or 455, pl. xxix, figs. 13, 14. Mus. No. 8881.

Helix ? veterna (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 596, pl. xlii, figs. 8*a*, *b*. Rev. Non-Marine Foss. Moll., p. 48 or 454, pl. xxx, figs. 4, 5. Mus. No. 1975.

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*Not the figured specimen, but marked as a type by T. A. Conrad.

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EOCENE SPECIES—Continued.

Limnæa (Limnophysa) vetusta Meek.
Rep. Expls. Great Basin of Utah, J. H. Simpson, p. 367, pl. v, figs. 3*a*, *b*. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 191, pl. xvii, figs. 4, *a*, *b*. Rev. Non-Marine Foss. Moll., p. 39 or 445, pl. xxix, figs. 22, 23. Mus. No. 693.

Limnæa similis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 191, pl. xvii, figs. 3, *a*. Rep. Expl. Great Basin of Utah, J. H. Simpson, p. 367, pl. v, fig. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 39 or 445, pl. xxix, figs. 20, 21. Mus. No. 692.

Macrocyclis spatiosa (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 594, pl. xlii, figs. 9*a–c*. Rev. Non-Marine Foss. Moll., p. 46 or 452, pl. xxx, figs. 1–3. Mus. No. 1974.

Meretrix californiana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 320, pl. ii, fig. 4. Mus. No. 1842.

Mesodesma bishopi White.
Rep. Geol. of Eastern Uinta Mts., J. W. Powell, p. 128 (not figured). Mus. No. 12509.

Natica ætitis Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 321, pl. ii, fig. 7. Mus. No. 1836.

Phorus exoneratus White.
Rep. Geol. of Eastern Uinta Mts., J. W. Powell, p. 134 (not figured). Mus. No. 12510.

Physa bridgerensis Meek.
Rep. Expls. & Survs. west of 100th Meridian, vol. iv, part i, p. 210, pl. xxi, fig. 2*a*. Mus. No. 8596.

Physa bridgerensis Meek.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 45, pl. xix, figs. 10*a*, *b*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxx, figs. 9, 10. Mus. No. 9001.

Physa pleromatis White.
Rep. Geogr. & Geol. Surv. west of 100th Meridian, vol. iv, part i, p. 211, pl. xxi, figs. 1*a*, *b*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxx, figs. 6, 7. Mus. No. 8867.

Planorbis æqualis White.
Proc. U. S. Nat. Mus., p. 159. Rev. Non-Marine Foss. Moll., p. 42 or 448, pl. xxix, figs. 8–10. Mus. No. 12486.

Planorbis cirratus White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 44, pl. xix, figs. 5*a–c*. Rev. Non-Marine Foss. Moll., p. 42 or 448, pl. xxix, fig. 7. Mus. No. 9005.

Planorbis spectabilis Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 190, pl. xvii, figs. 13*d–f*. Mus. No. 694.

Planorbis spectabilis Meek.
Rep. Expls. Great Basin of Utah, J. H. Simpson, p. 366, pl. v, figs. 7*a–d*. Rev. Non-Marine Foss. Moll., p. 41 or 447, pl. xxix, figs. 4–6. Mus. No. 695.

Planorbis spectabilis var. **utahensis** Meek.
Rep. Expls. Great Basin of Utah, J. H. Simpson, p. 367, pl. v, figs. 8*a–c*. Rev. Non-Marine Foss. Moll., p. 41 or 447, pl. xxix, figs. 1–3. Mus. No. 697.

EOCENE SPECIES—Continued.

Planorbis spectabilis var. **utahensis** Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 182, pl. xvii, figs. 14*a–c*. Mus. No. 697.

Planorbis utahensis (Meek) White.
Rep. Expls. & Survs. west of 100th Meridian, vol. iv, part i, p. 209, pl. xxi, fig. 8*a*. Mus. No. 8599.

Pleurotoma pagoda Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 149, pl. —, fig. 1. Mus. No. 1505.

Pleurotoma platysoma Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 150, pl. —, fig. 3. Mus. No. 8916.

Pleurotoma venusta Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 150, pl. —, fig. 2. Mus. No. 1509.

Pupa arenula White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 46, pl. xix, figs. 8*a*, *b*. Rev. Non-Marine Foss. Moll., p. 50 or 456, pl. xxix, fig. 19. Mus. No. 9002.

Pupa atavuncula White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 46, pl. xix, fig. 9*a*. Rev. Non-Marine Foss. Moll., p. 50 or 456, pl. xxix, fig. 18. Mus. No. 9002.

Pupa (Leucocheila) incolata White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 47, pl. xix, figs. 7*a–c*. Rev. Non-Marine Foss. Moll., p. 50 or 456, pl. xxix, figs. 15–17. Mus. No. 9004.

Scalaria unilineata Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 150, pl. —, fig. 5. Mus. No. 8920.

Succinea (Brachyspira) papillispira White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 45, pl. xix, fig. 4*a*. Rev. Non-Marine Foss. Moll., p. 51 or 457, pl. xxix, fig. 26. Mus. No. 9008.

Terebra plicifera Heilprin.
Proc. U. S. Nat. Mus., vol. iii, p. 151, pl. —, fig. 8. Mus. No. 8919.

Turritella uvasana Conrad.
Rep. Expls. & Survs. Mississippi River to the Pacific Ocean, vol. v, p. 321, pl. ii, fig. 12. Mus. No. 1870.

Unio clinopisthus White.
Rev. Non-Marine Foss. Moll., p. 28 or 434, pl. xxviii, figs. 1, 2. Mus. No. 8359.

Unio meekii White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 43, pl. xix, fig. 1*a*. Mus. No. 7833.

Unio shoshonensis White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 41, pl. xix, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 29 or 435, pl. xxviii, fig. 3. Mus. Nos. 8098, 8099.

Unio washakiensis (Meek) White.
12th Ann. Rep. U. S. Geol. & Geogr. Surv. Terr., p. 42, pl. xix, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 29 or 435, pl. xxviii, figs. 6, 7. Mus. Nos. 9006, 9007.

Unio washakiensis (Meek) White.
Rev. Non-Marine Foss. Moll., p. 29 or 435, pl. xxviii, fig. 8. Mus. No. 8876.

Viviparus paludinæformis (Hall) White.
Rev. Non-Marine Foss. Moll., p. 62 or 468, pl. xxx, figs. 11, 12. Mus. No. 8253.

Viviparus wyomingensis (Meek) White.
Rev. Non-Marine Foss. Moll., p. 62 or 468, pl. xxx, figs. 13, 14. Mus. No. 8295.

MIOCENE SPECIES.

Ancylus undulatus Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 186, pl. xvii, figs. 12, 12*a*. Rev. Non-Marine Foss. Moll., p. 45 or 451, pl. xxxii, fig. 10. Mus. No. 12532.

Anomia subcostata Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 325, pl. v, fig. 34. Mus. No. 1865.

Anomia subcostata Conrad.
Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 161, pl. xix, figs. 1*a*, *b*. Mus. No. 9830.

Arca devincta Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 726, pl. xviii, figs. 10, *a*. Mus. No. 3499.

Arca microdonta Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, pp. 323, 324, pl. iii, fig. 29. Mus. No. 1844.

Arca obispoana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. v, fig. 1. Mus. No. 13330.

Arcopagia unda Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. iv, figs. 3, 4. Mus. No. 13328.

Astrodapsis antiselli Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 196, pl. x, figs. 1, 2. Mus. No. 13337.

Axinea barbarensis Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. vi, fig. 3. Mus. No. 13358.

Balanus estrellanus Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 195, pl. viii, fig. 1. Mus. No. 13342.

Balanus estrellanus Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 195 (not the figured specimen). Mus. No. 13316.

Bulla petrosa Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 727, pl. xix, fig. 8. Mus. No. 3607.

Cardita subtenta Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 726, pl. xviii, figs. 12, *a*. Mus. No. 3502.

Cardium modestum Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi to the Pacific, vol. v, p. 322, pl. iii, fig. 15. Mus. No. 1864.

Crassatella collina Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 193, pl. vi, figs. 1, 2. Mus. No. 13339.

Crepidula prærupta Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 727, pl. xix, figs. 9, *a*, 10*a*, *b*. Mus. Nos. 3496, 3564.

Cyclas estrellana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. vi, fig. 6. Mus. No. 13351.

Cyclas estrellana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192 (not the figured specimen). Mus. No. 13314.

MIOCENE SPECIES—Continued.

Cyclas permacra Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. vii, fig. 4. Mus. No. 13340.

Dolium petrosum Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 727, pl. xix, figs. 3*a*, *b*, 4*a*, *b*, 5*a*, *b*. Mus. No. 3536.

Donax? protexta Conrad.
U. S. Expl. Exp., vol. x, Geology, pp. 723, 724, pl. xvii, fig. 9. Mus. No. 3613.

Dosinia longula Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 193, pl. vii, fig. 2. Mus. No. 13343.

Dosinia montana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. vi, fig. 4. Mus. No. 13357.

Dosinia subobliqua Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. vi, fig. 5. Mus. No. 13356.

Fusus corpulentus Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 728, pl. xx, fig. 4. Mus. No. 3551.

Galerites oregonensis Dana.
U. S. Expl. Exp., vol. x, Geology, p. 729, pl. xxi, figs. 5, 6, *a*. Mus. No. 3498.

Glycimeris estrellanus Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. vii, fig. 5. Mus. No. 13320.

Gratelupia? mactropsis Conrad.
Rep. Expls. & Survs. R. R. R. the Mississippi to the Pacific, vol. v, p. 328, pl. vi, fig. 54. Mus. No. 1843.

Helix leidyi (H. & M.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 604, pl. xlv, figs. 7*a*, *b*. Rev. Non-Marine Foss. Moll., p. 49 or 455, pl. xxxii, figs. 32, 33. Mus. No. 2102.

Helix leidyi (H. & M.) White.
Rep. Expls. & Survs. west of 100th Meridian, vol. iv, part i, p. 211, pl. xxi, figs. 3*a*–*c*. Mus. No. 8590.

Hinnites crassa Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 190, pl. ii, figs. 1, 2. Mus. No. 13336.

Latia dallii White.
Rev. Non-Marine Foss. Moll., p. 45 or 451, pl. xxxii, figs. 37–40. Mus. No. 11547.

Limnæa (Polyrhytis) kingii Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 192, figs. 6, 7, on p. 192. Rev. Non-Marine Foss. Moll., p. 40 or 446, pl. xxxii, figs. 30, 31. Mus. No. 8097.

Limnæa shumardi (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 599, pl. xlv, figs. 6*a*, *b*. Rev. Non-Marine Foss. Moll., p. 40 or 446, pl. xxxii, figs. 28, 29. Mus. No. 2119.

Lutraria transmontana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. v, fig. 6. Mus. No. 13322.

Lutraria traskei Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 324, pl. iii, fig. 23. Mus. No. 1848.

MIOCENE SPECIES—Continued.

Mactra ? gaviotensis Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. vii, fig. 4. Mus. No. 13310.

Modiola contracta Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 325, pl. v, fig. 35. Mus. No. 1853.

Mya abrupta Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 723, pl. xvii, figs. 5, *a*. Mus. No. 3608.

Mytilus inezensis Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 194, pl. viii, figs. 2, 3? Mus. No. 13319.

Natica inezana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 195, pl. x, figs. 5, 6. Mus. No. 12359.

Natica inezana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to Pacific Ocean, vol. vii, p. 195, pl. x, figs. 5, 6. Mus. No. 12359.

Nautilus angustatus Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 728, pl. xx, fig. 5. Mus. No. 3610.

Nucula impressa Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 726, pl. xviii, figs. 7*c*–*e*. Mus. Nos. 3490, 3491.

Ostrea contracta Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 160, pl. xviii, figs. *a*–*d*. Mus. No. 9904.

Ostrea panzana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 193, pl. ii, fig. 4. Mus. No. 13313.

Ostrea subjecta Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to Pacific Ocean, vol. vii, p. 193, pl. ii, fig. 3. Mus. No. 13338.

Ostrea vespertina Conrad.
U. S. & Mex. Bound. Surv., vol. i, part ii, p. 160, pl. xvii, figs. 1*a*–*d*. Rev. Foss. Ostreida N. A., p. 315, pl. lxxi, figs. 2–5. Mus. No. 9832.

Pachydesma inezana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 193, pl. v, figs. 2, 4. Mus. No. 13315.

Pallium estrellanum Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 191, (not the figured specimens). Mus. No. 13317.

Pecten discus Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 190, pl. iii, fig. 1. Mus. No. 13335.

Pecten hermanii Conrad.
Proc. Acad. Nat. Sci. Philad., vol. vii, p. 267. Mus. No. 13309.

Pecten magnolia Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 191 (not the figured specimen). Mus. No. 13311.

Pecten meekii Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 190, pl. i, fig. 1. Mus. No. 13333.

Pecten propatulus Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 726, pl. xviii, figs. 13, *a*. Mus. No. 3504.

MIOCENE SPECIES—Continued.

Pectunculus patulus Conrad.
U. S. Expl. Exp., vol. x, geology, p. 726, pl. xviii, figs. 8, *a*. Mus. No. 3605.

Perna montana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 195 (not figured). Mus. No. 13329.

Physa secalina (E. & S.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 604, pl. xlv, figs. 4*a*, *b*. Rev. Non-Marine Foss. Moll., p. 44 or 450, pl. xxxii, figs. 35, 36. Mus. No. 2140.

Planorbis nebrascensis (E. & S.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 600, pl. xlv, figs. 2*a*, *b*. Rev. Non-Marine Foss. Moll., p. 42 or 446, pl. xxxii, figs. 22, 23. Mus. No. 2170.

Planorbis vetustus (M. & H.) Meek.
Rep. U. S. Geol. & Geogr. Surv. Terr., 4to, vol. ix, p. 601, pl. xlv, figs. 1*a*–*c*. Rev. Non-Marine Foss. Moll., p. 42 or 446, pl. xxxii, figs. 16–18. Mus. No. 2171.

Scutella striatula.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, pl. ix, figs. 1*a*, *b*. Mus. No. 13334.

Sigaretus scopulosus Conrad.
U. S. Expl. Exp., vol. x, geology, p. 727, pl. xix, figs. 6, *a*. Mus. No. 3553.

Solemya ventricosa Conrad.
U. S. Expl. Exp., vol. x, geology, p. 723, pl. xvii, figs. 7, 8. Mus. Nos. 3567, 3486.

Sphærium idahoense Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 183, pl. xvi, figs. 1, *a*. Mus. No. 12520.

Sphærium rugosum Meek.
Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 182, pl. xvi, figs. 2, *a*, *b*. Mus. No. 12521.

Tapes inezensis Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. vii, fig. 1. Mus. No. 13341.

Tapes montana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. v, figs. 3–5. Mus. No. 13321.

Tellina arctata Conrad.
U. S. Expl. Exp., vol. x, geology, p. 725, pl. xviii, figs. 3, *a*. Mus. No. 3849.

Tellina congesta Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 323, pl. iii, figs. 21, *a*. Mus. No. 1849.

Terebratula nitens Conrad.
U. S. Expl. Exp., vol. x, geology, p. 726, pl. xix, figs. 1, *a*. Mus. No. 3487.

Teredo substriata Conrad.
U. S. Expl. Exp., vol. x, geology, p. 728, pl. xx, fig. 7. Mus. No. 3481.

Trochita costellata Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 195, pl. vii, fig. 3. Mus. No. 13310.

Turritella biseriata ? Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi to the Pacific, vol. v, p. 320, (not figured nor described). Mus. No. 1866.

Turritella inezana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 195 (not the figured specimen). Mus. No. 13344.

MIOCENE SPECIES—Continued.

Turritella variata Conrad.
Rep. Expls. & Survs. R. R. R. from Mississippi River to the Pacific Ocean, vol. vii, p. 195, pl. viii, fig. 5. Mus. No. 13346.

Venus bisecta Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 724, pl. xvii, figs. 10, *a*. Mus. No. 3518.

Venus brevilineata Conrad.
U. S. Expl. Exp., vol. x, Geology, p. 724, pl. xvii, fig. 13. Mus. No. 3606.

Venus lamellifera Conrad.
U. S. Expl., Exp. vol. x, Geology, p. 724, pl. xvii, fig. 12*a*. Mus. No. 3611.

Venus pajaroana Conrad.
Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 192, pl. iv, figs. 1, 2. Mus. No. 13318.

POST-TERTIARY AND TERTIARY SPECIES OF DOUBTFUL AGE.

Ancylus undulatus Meek.
Tertiary. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 186, pl. xvii, fig. 12*b*. Mus. No. 12532.

Anomia subcostata Conrad.
Tertiary. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 161, pl. xix, figs. 1*a*, *b*. Mus. No. 9830.

Carinifex (Vorticifex) binneyi Meek.
Tertiary. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 187, pl. xvii, figs. 11, *a*. Mus. No. 12542.

Carinifex (Vorticifex) tryoni Meek.
Tertiary. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 188, pl. xvii, figs. 10, *a*, *b*. Mus. No. 12544.

Carinifex (Vorticifex) tryoni var. **concava** Meek.
Tertiary. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 189, pl. xvii, fig. 10*c*. Mus. No. 13416.

Cassidula alveata Conrad.
Tertiary. Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 163, pl. xix, figs. 9*a*, *b*. Mus. No. 9901.

Corbula nasuta Conrad.
Tertiary. Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 161, pl. xix, fig. 4. Mus. No. 9899.

Crepidula princeps Conrad.
Post-tertiary. Rep. Expls. & Survs. R. R. R. from the Mississippi to the Pacific, vol. v, p. 326, pl. vi, figs. 52, *a*. Mus. No. 1839.

Fissurella crenulata (Sow.) Conrad.
Post-tertiary. Rep. Expls. & Survs. R. R. R. from the Mississippi to the Pacific, vol. v, p. 326, pl. v, fig. 44. Mus. No. 1851.

Melania ? sculptilis Meek.
Tertiary. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 195, pl. xvii, fig. 8. Mus. No. 12541.

Melania ? subsculptilis Meek.
Tertiary. Rep. Geol. Expl. 40th Parallel, vol. iv, part i, p. 196, pl. xvii, fig. 9. Mus. No. 12551.

Natica limula Conrad.
Tertiary. Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 162, pl. xix, fig. 7. Mus. No. 9898.

Ostrea veleniana Conrad.

Tertiary. Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 160, pl. xvii, figs. 2*a*, *b*. Rev. Foss. Ostreidæ N. A., p. 314, pl. lxx, fig. 1. Mus. No. 9902.

Pecten altiplicatus Conrad.

Tertiary. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. vii, p. 191, pl. iii, fig. 2. Mus. No. 13350.

Pecten deserti Conrad.

Tertiary. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 325, pl. v, fig. 41. Mus. No. 8398.

Penitella spelæa Conrad.

Post-pliocene. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 326, pl. v, figs. 43, *a*, *b*. Mus. No. 1868.

Planorbis ammon Gould.

Post-tertiary. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 331, pl. xi, figs. 14–16. Mus. No. 13392.

Potamis pullatus Gould.

Post-tertiary. Rep. Expls. & Survs. R. R. R. from the Mississippi to the Pacific, vol. v, p. 333, pl. xi, fig. 23. Mus. No. 13393.

Saxicava abrupta Conrad.

Post-pliocene. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 324 (not figured). Mus. No. 1869.

Schizothœrus nuttalli Conrad.

Post-pliocene. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, p. 324, pl. iv, figs. 33, *a*. Mus. No. 1845.

Scutella interlineata Blake.

Post-pliocene. Rep. Expls. & Survs. R. R. R. Mississippi River to the Pacific Ocean, vol. v, [pl. iv, fig. 30] (not named nor described). Mus. No. 1846.

Tapes diversum (Sow.) Conrad.

Post-tertiary. Rep. Expls. & Survs. R. R. R. from the Mississippi to the Pacific, vol. v, p. 324, pl. iv, figs. 31, *b*. Mus. No. 1847.

Turritella sp. Conrad.

Tertiary. Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 163, pl. xix, fig. 8. Mus. No. 9903.

Volutalithes sayana Conrad.

Tertiary. Rep. U. S. & Mex. Bound. Surv., vol. i, part ii, p. 162, pl. xix, fig. 6. Mus. No. 9897.

ON TURBINELLA PYRUM, LAMARCK, AND ITS DENTITION.

By W. H. DALL.

Nothing has been known of the soft parts of this genus, though Gray* characterized the operculum. Troschel obtained an alcoholic specimen with some difficulty, only to find the soft parts in a state of decay which had left no trace even of the radula.†

After many efforts, extending over more than six years, I recently obtained for the National Museum a specimen of the typical form, obtained by Dr. J. Wood-Mason at the Andaman Islands some twelve years ago and sent by the India Museum of Calcutta, through his courtesy, to Washington.

On extracting the soft parts it was found that granular degeneration had progressed to such an extent that nothing could be made out in regard to the viscera or branchiæ; only the tougher parts near the aperture of the shell retained their solidity, and these were so contracted that it was necessary to cut them apart to get any idea of the form of the living animal. The operculum was elongate-oval, with the width less than one-third the length. There was a small part of it free from the integument, but less than in that of *T. cornigera*, which is smaller, more curved, with deeper notches for the columellar plaits on the inner side, with a larger deposit of polished callus on the under side, and altogether heavier and more solid.

The foot appeared, in its contracted state, to be small for the weight of the shell, rather broad and truncate, with bluntly-rounded corners in front and broadly rounded behind. The two corners were folded toward each other under the base, but the tail was not turned under. The sides of the foot were not ornamented with any appendages, but were smooth, except for numerous projecting granulations irregularly disposed and due to small aggregations of crystals of lime under the skin, as in some *Dorididæ*. These had considerable areas about them where there were no crystals, and were not marked by any coloration. Similar granulations appeared more sparingly on the mantle margin, which was smooth and plain. The color of the animal was whitish, with black or very dark olive-brown streaks, especially near the margin of the foot. There appeared to be a pedal gland. There was a very deep sinus between the cephalic parts and the upper front edge of the foot. The mantle extended to the end of the canal, and the siphon took its origin at some distance behind the anterior part of the edge of the canal-mantle lining. Both were much contracted. The tentacles, as contracted in the spirits of wine, were disproportionately

* Mrs. Gray's Moll., iv, p. 68; Guide, p. 31.

† Geb. der Schnecken, ii, p. 84.

small and short, the tips hardly prolonged beyond the eye, and forming a blunt oblique point. In life, however, they were probably more extended. The mouth was large, circular, and radiately wrinkled. The proboscis long, white, muscular, cylindrical or gently tapering to the point, which was laterally compressed, making the orifice nearly a vertical slit. The gullet was extremely capacious, forming a densely laminated crop, which extended backward as far as the tissues were preserved. There were no jaws. The gills, genitalia, &c., were decayed so as to prevent recognition or description. The radula was disproportionately small and contained about eighty rows of teeth transversely; formula, 1 · 1 · 1 or 1 · $\frac{1}{3}$ · 1. Its total length was about 0.2 of an inch, the proboscis being about 2.25 in all. The rhachidian tooth is provided with a wide, doubly arched base and with three cusps, close together, of which the median one is about twice as long as the other two. Laterals simple, broad, strong, with a single cusp. There was no indication of any small outer cusp, such as is figured for *T. cornigera* by Troschel.

The teeth recall those of *Cynodonta cornigera* and differ from them chiefly in the greater width of the rhachidian base and the absence of the denticulations on the outer corners of the laterals. These last were found in two instances by Troschel, who ascribed their absence from Gray's figure by supposing that they were broken or abortive, as occasionally happens.

We may now consider the bearing of our new information on the systematic position of Turbinella. It would seem that its characters as derived from the soft parts merely confirm those derived from the shell, by which it has been hitherto classified; a fact less startling but perhaps not less significant than the cases in which the diagnosis from the shell has not been fully borne out by a later knowledge of the complete anatomy.

The typical species of the genus included in *Voluta* by Linné was named Turbinella by Lamarck in 1799. It had previously received the catalogue name of *Xancus* from Bolten in 1798, in allusion to its Indian name of sianko or shank-shell. Bolten's name was never defined or illustrated by him, and has merely an historical interest, although five years after Lamarck's paper, Link put Bolten's name on a scientific basis by defining it, as well as Bolten's other name of *Vasum*, for the rough Turbinellas, afterward called *Cynodonta* by Schumacher. We may formulate the nomenclature as follows:

TURBINELLA Lamarck.

Historical synonymy:

Mazza, Klein, Tent. Meth., p. 62, 1753—*pro parte.*
Rapum et murex, sp. Humphrey, Mus. Cal., 1797.
Xancus Bolten, Mus. Bolt., p. 134, 1798. *Ib.*, 1819, p. 94.

Actual synonymy:

Turbinella Lam., Prodr., pp. 73, 91, 1799, sole ex. *V. pyrum* L.
Turbinellus Cuvier, Anat. Comp., 1800; Lamarck, 1801, &c.
Turbinella Bosc, Hist. des Moll., vol. v, p. 35, 1802.
Xancus Link, Beschr. Rost. Samml., iii, p. 116, 1807.
Turbinellarius Duméril, Zoöl. Analyt., p. 166, 1806.
Turbinella Schumacher, Essai, p. 240, 1816.
Mazza H. & A. Adams, Gen. Rec. Moll., 1, p. 156, 1853.
Scolymus Deshayes in Lam. ed. ii, ix, p. 375, 1843, not of Swainson.

The sole example and type of Lamarck was the *Voluta pyrum* of Linné. A number of species has been added since, the distinctness of most of which is somewhat doubtful.

The second group, which is very closely allied to the typical Turbinellas, and which can hardly rank above a subgenus, was named by Link who adopted the earlier catalogue name given by Bolten and supplied a definition.

VASUM Link.

Historical synonymy:

Vasum Bolten, Mus. Bolt., p. 56; 1798; Ed. 1819, p. 40.

Actual synonymy:

Vasum Link, Beschr. Rost. Samml., iii, p. 119, 1807.
Cynodonta Schumacher, Essai, p. 73, 1816.
Cynodona Schumacher, *l. c.*, p. 241, 1816, Err. typogr.
Scolymus Swainson, Malac., pp. 78, 304, 1840. Not Deshayes, 1843.
Volutella Perry, Conch., plate xxvi, 1811.
Clava Fabricius, Fortegn., p. 79, 1822; fide Herrmannsen Suppl., p. 31.

Link's first species was *Voluta ceramica* of Linné, which with *V. cornigera* may be taken as types of the group.

It might appear at first sight as if there was little in common between the rugged nodose *Vasum* and the smooth rounded *Turbinella*, but when the different species are all taken into account it is evident that the distinguishing characters are not such as are usually considered of high systematic value. Even *T. pyrum* is often marked with rows of small nodules on a series of two or three revolving ridges; the length of the canal and the form of the shell vary within wide limits within the genus and even with the typical species. The soft parts, dentition, and opercula do not differ more than we might find between species of accepted genera in other groups, and the characters of the subgenus *Vasum* are, as compared with those *Turbinella* proper, of degree and not of kind.

To summarize them briefly it may be said that *Turbinella* is characterized by a generally longer canal and smoother surface, more ovate operculum and lighter colored shell and, perhaps, by unicuspid lateral teeth; *Vasum*, by a nodose or cancellate surface, shorter canal and more pyramidal shell, narrower and heavier operculum and, perhaps, by bicuspid laterals.

The family should take the name of *Turbinellidæ*, from its original genus and most distinctive type, and this has been the general usage of malacologists.

FIGURES. (Plate XIX, this volume).

TURBINELLA PYRUM Lam.

1. Rhachidian and one lateral tooth.
2. End of siphonal fold, the right mantle edge cut away to show the internal fold.
3. Extremity of proboscis from above.
4. Extremity of left tentacle, with eye.
5. General outline of radula.
6. *Turbinella pyrum* Lamarck, crawling.

A REVIEW OF THE AMERICAN "GOLDEN WARBLERS."

By ROBERT RIDGWAY.

In a short paper* published in the Proceedings of the Biological Society of Washington, vol. iii, pp. 1–4, I briefly characterized a new form of this group from the island of Cozumel, Yucatan, under the name of *Dendroica petechia rufivertex.* The birds of this group being much confused, it was found necessary, before the status of the Cozumel bird could be determined, to carefully examine all the material available (embracing considerably more than one hundred specimens from tropical America, besides a very extensive series of *D. æstiva* from North America); and as the results of this examination may be of interest, a brief synopsis is herewith presented, together with a fuller diagnosis of the Cozumel form, and also another new one from Lower California and western Mexico:

DENDROICA PETECHIA RUFIVERTEX.

Dendroica petechia rufivertex, RIDGW. Proc. Biol. Soc. Washington, vol. iii, Feb. 26, 1885, p. 1.

SUBSP. CHAR.—Similar to *D. petechia ruficapilla* (Gmel.), of St. Thomas and other Lesser Antilles, but with shorter wings and tail, and rather more intense coloration.

Adult ♂ (type No. 102508, U. S. Nat. Mus., Cozumel I., Yucatan, January 28, 1885; J. E. Benedict and T. Lee): Whole crown orange-rufous, the feathers rich gamboge-yellow basally. Nape, back, scapulars, and rump bright yellowish olive-green; upper tail-coverts similar, but edged with yellow. Wings blackish dusky, the feathers broadly margined with olive-yellow (almost pure yellow on the coverts and tertials). Outer webs of rectrices dusky, edged with olive-green; inner webs chiefly bright primrose-yellow. Lower parts, including whole side of head, very rich fine gamboge-yellow, the jugulum, breast, sides, and flanks broadly streaked with rich chestnut-rufous; throat with much smaller and indistinct streaks. Wing, 2.40; tail, 2.05; culmen, .55; bill from nostril, .30; tarsus, .80; middle toe, .45.

* "Descriptions of some new species of birds from Cozumel Island, Yucatan."

Seven adult males agree closely in the characters given above. There is some variation, however, which it may be well to note. Two specimens have the whole throat distinctly streaked, while two have scarcely a trace of these streaks, the others being intermediate. All have the whole crown bright orange-rufous, except one, in which only the anterior part of the crown is of this color. The color of the crown-patch is not so dark as in *D. rufo-pileata* from Old Providence (see these "Proceedings," vol. vii, p. 173), neither is it abruptly outlined as in that species and *D. capitalis* Lawr., from Barbadoes. The relationships of this form are decidely with *D. petechia ruficapilla* and *D. petechia melanoptera*, of the Lesser Antilles, difference of proportion being the chief distinction, the former being larger, the latter smaller, than the Cozumel race.

It is with much reluctance that I here present an additional race of this perplexing group; and it is only after the most careful consideration of the subject that I have concluded to do so. Anomalies in the distribution of the several local forms indicate the importance of distinguishing them by name, in order that the subject may be more conveniently handled.

The group is a most interesting and at the same time very perplexing one. In most forms the characters are easily recognizable, the differentiation having reached a point which may be regarded as specific. In other cases the differentiation, while equally constant, is comparatively slight, and perhaps best considered as of subspecific value only. Proceeding on this basis, the group of "Golden Warblers," as at present known, may be arranged as follows, the arrangement here presented being based on more than one hundred adult males:

A. Tarsus usually less, and never more, than .75 of an inch; head of adult male yellow, the crown more olivaceous, and never with a distinct suffusion or patch of rufous.

1. **D. æstiva** (GM.).—*Hab.* Continental; whole of North America, south in winter through Central America, to Colombia, Venezuela, Guiana, Trinidad, and Tobago.

B. Tarsus usually more, and never less, than .75 of an inch.

a. Head of adult male yellow, the crown with a distinct suffusion of orange-rufous.

2. **D. petechia.**

+ *α. petechia* (LINN.).—*Hab.* Jamaica; Hayti?

Motacilla petechia, LINN.—*Dendroica petechia* Scl.

Dendroeca petechia, (*e*) *jamaicensis* SUND.

+ *β. gundlachi* BAIRD.—*Hab.* Cuba; Bahamas.

Dendroica gundlachi BAIRD.—*D. petechia*, var. *gundlachi* B. B. & R.

Dendroeca petechia (*d*) *cubana* SUND.

+ *γ. ruficapilla* (GM.).—*Hab.* Porto Rico; St. Thomas; St. Croix; St. Bartholomew; St. Kitts; St. Eustatius; Antigua; Martinique??

Motacilla ruficapilla GMEL.—*Dendroica ruficapilla* BAIRD, Review.—*Dendroica petechia*, var. *ruficapilla* B. B. & R.

Dendroeca petechia (a) *bartholemica* SUND.

Dendroeca petechia (b) *cruciana* SUND.

δ. *melanoptera*, Lawr.—*Hab.* Guadeloupe; Dominica.
Dendroica petechia, var. *melanoptera* Lawr.

ε. *rufivertex* Ridgw.—*Hab.* Cozumel I.. Yucatan.

ξ. *aureola* (Gould).—*Hab.* Galapagos Islands.
Sylvicola aureola, Gould.—*Dendroica aureola* Baird.
Dendroeca petechia (f) *gallapagensis* Sund.

b. Head of adult male yellow, the crown with a sharply defined patch of rufous or chestnut.

3. **D. capitalis** Lawr.—*Hab.* Barbadoes.
Dendroica capitalis Lawr.; Baird; B. B. & R. Curaçao
Dendroeca petechia (c) *barbadensis* Sund.

4. **D. rufo-pileata** Ridgw.—*Hab.* Island of ~~Old~~ Providence, Caribbean Sea.

c. Head of adult male entirely rufous or chestnut.

5. **D. rufigula** Baird.—*Hab.* Martinique.
Dendroica rufigula Baird.

6. **D. vieilloti** Cass.

α. *vieilloti* Cass.—*Hab.* Northern Colombia (Cartagena).

β. *panamensis* Sund.—*Hab.* Panama; Costa Rica (Nicoya).
Dendroeca petechia (i) *panamensis* Sund.
Dendroica vieilloti Cass. (part; specs. ex Panama).
Dendroica vieilloti, var. *rufigula* B. B. & R. (*nec D. rufigula* Baird).

7. **D. bryanti** Ridgw.

α. *bryanti* Ridgw.—*Hab.* Atlantic coast, Belize to Northern Yucatan (Merida).
Dendroica vieilloti, var. *bryanti*, Ridgw.; B. B. & R.

β. *castaneiceps* Ridgw.*—*Hab.* Western Mexico (Mazatlan); Cape St. Lucas.

Subsp. char.—Differing from true *D. bryanti* in having the head rich chestnut instead of rufous. *Adult* ♂ (type, No. 89940, U. S. Nat. Mus., La Paz, Lower California, Dec. 16, 1882; L. Belding): Head rich chestnut, lighter or more rufous on the throat. Upper parts olive-green, the wings dusky, with broad greenish yellow edgings; outer webs of rectrices dusky, edged with yellowish olive-green, the inner webs chiefly primrose-yellow. Lower parts bright gamboge-yellow, the jugulum and breast with a few very indistinct and mostly concealed streaks of chestnut-rufous. Bill dusky. Feet, dark horn-color. Wing, 2.70; tail, 2.20; culmen, .58; bill from nostril, .35; tarsus, .80; middle toe, .49.

Adult ♀ (No. 89942, U. S. Nat. Mus., La Paz, Lower California, December 29, 1882): Above grayish olive-green; wings grayish dusky, the feathers edged with olive-grayish; rectrices dusky, outer webs edged with olive-green, the inner with primrose-yellow. Lower parts dull pale olive-yellowish. Wing, 2.50; tail, 2.10; culmen, .55; bill from nostril, .30; tarsus, .80; middle toe, .45.

Hab.—Western Mexico (vicinity of Mazatlan) and vicinity of La Paz, Lower California.

The male selected as the type is the one having the head lightest in color of the three Lower Californian examples before me. The other two differ as follows:

No. 86260, U. S. Nat. Mus., La Paz, January 6, 1882; L. Belding: Head slightly darker chestnut, especially the pileum; breast with the streaks rather more distinct (but still very faint), and sides similarly streaked. Wing, 2.60; taii, 2.25.

No. 89938, La Paz, December 19, 1882; L. Belding: Head still darker chestnut than in No. 86260. Streaks on lower parts about the same. Wing, 2.60; tail, 2.10.

Young males, obtained in December, are similar to the female, as described, but brighter in color and with the head more or less touched or mixed with chestnut.

Two adult males from Mazatlan are essentially identical with the La Paz specimens. They measure as follows:

No. 58252, Mazatlan; Col. A. J. Grayson: Wing, 2.50; tail, 2.10.

No. 35017, Mazatlan, August; Col. A. J. Grayson: Wing (molting); tail (molting). "Bill black above, margined with paler; under mandible lead-color."

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* *Dendroica bryanti castaneiceps*, subsp. nov.

NOTES ON THE MINERALOGY AND LITHOLOGY OF THE DISTRICT OF COLUMBIA.

By GEORGE P. MERRILL.

Since the publication by the author of two previous papers bearing on this subject,* the work on the extension of the Washington City water-works has been commenced and rapidly pushed toward completion. This work includes the construction of a tunnel through the underlying rock in the northwestern portion of the city, extending from the distributing reservoir beyond Georgetown to the new reservoir now in process of construction near Howard University, a total distance of 21,400 feet. To facilitate the construction of this tunnel, shafts have been sunk to the proper depths at Howard University, Champlain avenue, Rock Creek, Foundry Branch, and at the western extremity near the present distributing reservoir northwest of Georgetown.

The materials taken from these shafts and the tunnel have been carefully examined, and while, with perhaps a single exception, no rocks have as yet appeared of a different kind from those known to occur on the surface, several minerals have been brought to light never before reported from this vicinity, and which, in the majority of cases, have not yet been found in other than very small and perhaps microscopic forms in the surface rock. It is the object of this paper to call attention to those minerals of special interest that, so far as the author is aware, have not been reported heretofore.†

EPIDOTE.—As a constituent of the rock epidosite this mineral occurs in very minute crystals in a vein of unknown width which crosses the New Cut road a few rods east of Foundry Branch. The rock is very fine grained and of a yellowish-green color, and is frequently associated with massive quartz, prochlorite, and menaccanite. A similar vein has been passed through by the tunnel at Champlain avenue. In curved columnar forms the epidote sometimes occurs embedded in the prochlorite. We have received from Professor Robinson a specimen of this form in which the crystals are some 10 centimeters long and 5 to 6 millimeter in breadth. They are broken several times transversely, and the fractures have become filled with prochlorite. The finest crystals yet seen were found by Mr. L. H. Merrill embedded in the quartz veins of amphibolite which had been thrown out from the tunnel at Rock Creek.

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* Preliminary notes on the Crystalline Schists of the District of Columbia, these Proceedings, vol. vi, 1883, pp. 159–161, and on Prochlorite from the District of Columbia, these Proceedings, vol. vii, 1884, p. 67.

† It may be well to state here that Professor Robinson, of Howard University, has kindly volunteered to collect for the Museum a full suit of specimens at intervals of every 50 feet throughout the entire length of the tunnel. We hope to make a thorough study of these after the completion of the work.

They are about a centimeter in diameter, in well defined six-sided prisms, and are of a dull greenish brown color. Owing to the toughness of the surrounding material the crystals so far obtained are badly fractured and without good terminations.

APATITE—This mineral, which until recently had been found only in microscopic crystals, has lately been discovered by Mr. L. H. Merrill in masses of considerable size embedded in white quartz from a vein in the shaft at Rock Creek. The largest found were some 2 centimeters in diameter, of distinct hexagonal outline, and of a light yellowish-green color. The majority of the specimens are, however, distorted and of irregular form. On account of their being embedded in tough, massive quartz it is impossible to obtain perfect crystals, and all yet obtained are more or less shattered and broken.

BLACK TOURMALINE.—This mineral is a very common constituent of the District rocks, occurring usually as small acicular crystals penetrating the quartz of veins. It has been found also in radiating forms on amphibolite, in curved trigonal prisms 4 to 5 millimeters in diameter embedded in prochlorite, as a very fine granular aggregate in quartz veins, and more rarely in columnar crystals of considerable size in the quartzose portions of the amphibolite. It has also been found by Professor Robinson at the Howard University shaft penetrating calcite.

MENACCANITE.—Aside from the usual grains scattered throughout the rock this mineral has been taken from the Foundry Branch tunnel in thin plates interlaminated with quartz or more commonly prochlorite. The thickness of the plates varies up to 2 millimeters, usually being about half this amount. They are commonly curved and an inch or more in diameter. The associated minerals are prochlorite, epidote, and quartz.

SPHENE.—This was first found in imperfect and broken crystals of a yellowish-green color, quite clear, and semi-transparent. Owing to its high fusibility and its evident pronounced cleavages in two directions there was at first some doubt as to its exact nature. Particles of the clear portions were therefore picked out and submitted to Professor Clarke for analysis, with the results given below:

Ignition	.54
SiO_2	30.10
TiO_2	40.82
CaO	28.08
Mg. O	40
Mn. O	Trace.
	99.94
Specific gravity	3,452

Later more and better specimens were found in which the characteristic wedge-shape crystalline form is unmistakable. The largest specimen obtained is about 2 centimeters in greatest diameter and occurs,

Vol. VIII, No. 23. Washington, D. C. Sept. 2, 1885.

as do most of the others, embedded in prochlorite. They are all very brittle and none have been removed entire from the matrix. The pronounced cleavage property above alluded to I am now inclined to think to be caused by repeated twinning, as recently described by Dr. G. H. Williams.*

STILBITE.—This mineral is of common occurrence forming a thin coating on the joint surfaces of both the hornblendic and micaceous rocks of the District. No really good material was found, however, until the work on the tunnel was commenced. The most common form is that of thin radiating blades coating the surface of the rock. Mr. True, of the National Museum, has, however, found it in small rectangular prisms implanted upright on thin layers of calcite. These forms are usually but a few millimeters in length and of a faint yellowish color. The largest specimens yet obtained were taken by myself from a narrow vein of calcite in the amphibolite, about 1,250 feet west from the eastern end of the tunnel by Howard University. These are some 15 millimeters in diameter and about the same length.

LAUMONTITE.—This, in connection with stilbite and prochlorite, is now one of the most common minerals of the District, although, until identified by myself from material gathered from the water-works tunnel, its presence has not before been recognized. The common form is that of a mass of imperfect crystals associated with calcite in narrow veins in the mica or hornblende rock. I have also found it in four-sided prisms with the ordinary oblique terminations, in small geodic cavities in the calcite veins. The best crystals are about 1 centimeter long by 4 millimeters broad and of a white or reddish color.

HEULANDITE.—This occurs in minute right rhomboidal prisms from 1 to 2 millimeters in diameter coating the surfaces of natural joints or in small cavities in the prochlorite. So far as examined the crystals present no unusual forms, and are of a grayish or yellowish-gray color with the characteristic pearly luster.

PROCHLORITE.—Attention was first called to the occurrence of this mineral in the District by myself in April, 1884.† Since that time considerable quantities of the material have been taken from the water-works tunnel, a few rods west of the shaft at Foundry Branch. It occurs most abundantly associated with the vein of epidote rock above alluded to. Specimens have also been taken from the tunnel near Rock Creek, Champlain avenue, and Howard University, showing it to be generally distributed throughout the rocks of the District. I have also found it on the surface in narrow veins in the amphibolite near the mouth of Foundry Branch, where it empties into the Potomac River.

JULY 20, 1885.

*Am. Jour. of Sci., June, 1885, p. 486.

†These Proceedings, vol. vii, 1884, p. 67.

SOME EMENDED NAMES OF NORTH AMERICAN BIRDS.

By ROBERT RIDGWAY.

The following names, adopted by the "Committee on Classification and Nomenclature" of the American Ornithologists' Union, represent new or hitherto unpublished combinations. They are here presented in order that the first known use of such combinations may be cited among the references which the committee has decided to give under each species, viz, the first pertinent binomial or trinomial appellation, and the first use of the name as adopted in the new list now being prepared by the committee.

When the species is one given in the writer's "Nomenclature of North American Birds" (Bulletin 21, U. S. National Museum), the corresponding name and number are given; but in the case of species described since the "Nomenclature" was published, the full reference to the original description is given.

Parus inornatus griseus. *Lophophanes inornatus griseus* Ridgw., Pr. U. S. Nat. Mus., v, Sept. 5, 1882, 344.

Parus inornatus cineraceus. *Lophophanes inornatus cineraceus* Ridgw., Pr. U. S. Nat. Mus., vi, Oct. 5, 1883, 154.

Parus cinctus obtectus (Cab.). [44.] *Parus cinctus* Bodd.

Psaltriparus minimus grindæ. *Psaltriparus grindæ* Belding, Pr. U. S. Nat. Mus., vi, Oct. 5, 1883, 155.

Thryothorus bewickii bairdi (Salv. & Godm.). 61*b*. *Thryomanes bewicki leucogaster,* Baird.

Thryothorus brevicaudus. 62. *Thryomanes brevicauda.*

Helminthophila ruficapilla gutturalis Ridgw. *Helminthophaga ruficapilla,* var. *gutturalis,* Ridgw. in Hist. N. Am. B., I. 1874, 191.

Helminthophila cincinnatiensis. 78*a*. *Helminthophaga cincinnatiensis.*

Sylvania pusilla pileolata. 125*a*. *Myiodioctes pusillus pileolatus.*

Sylvania canadensis. 127. *Myiodioctes canadensis.*

Sylvania microcephala, Ridgw. 126. *Myiodioctes minutus.* (*Musicapa minuta* preocupied!)

Geothlypis formosa. 119. *Oporornis formosa.*

Seiurus noveboracensis notabilis. 116*a*. *Siurus nævius notabilis.*

Vireo bellii pusillus. 146. *Vireo pusillus.*

Piranga rubra cooperi. 164*a*. *Pyranga æstiva cooperi.*

Loxia curvirostra minor (Brehm). 172. *Loxia curvirostra americana.*

Loxia curvirostra stricklandi, Ridgw. 172*a*. *Loxia curvirostra mexicana.* (*Loxia mexicana* preoccupied!)

Acanthis brewsterii. 180. *Ægiothus brewsteri.*

Ammodramus princeps. 192. *Passerculus princeps.*

Ammodramus sandwichensis. 193. *Passerculus sandwichensis.*

Ammodramus sandwichensis savanna. 193*a*. *Passerculus sandwichensis savanna.*

Ammodramus sandwichensis alaudinus. 193*b*. *Passerculus sandwichensis alaudinus.*

Ammodramus sandwichensis bryanti. *Passerculus sandwichensis bryanti* Ridgw., Pr. U. S. Nat. Mus., vi, Jan. 19, 1885, 517.

Ammodramus beldingi. *Passerculus beldingi* Ridgw., Pr. U. S. Nat. Mus. vi, Jan. 19, 1885, 516.

Ammodramus rostratus guttatus. 195. *Passerculus guttatus.*
Ammodramus savannarum passerinus. 198. *Coturniculus passerinus.*
Ammodramus savannarum perpallidus. 198*a*. *Coturniculus passerinus perpallidus.*
Junco cinereus dorsalis. 221. *Junco dorsalis.*
Melospiza georgiana (Lath.). 233. *Melospiza palustris.*
Icterus icterus (Linn.). 265. *Icterus vulgaris* Daud.
Corvus corax sinuatus (Wagl.). 280. *Corvus corax carnivorus.*
Pica pica hudsonica. 286. *Pica rustica hudsonica.*
Aphelocoma sieberii arizonæ. 295. *Aphelocoma sordida arizonæ.*
Dryobates villosus leucomelas. 360*a*. *Picus villosus leucomelas.*
Dryobates villosus audubonii (Sw. & Rich.). *Picus audubonii* Sw. & Rich., F. B. A., ii, 1831, 306.
Dryobates villosus harrisii. 360*b*. *Picus villosus harrisi.*
Dryobates pubescens gairdnerii. 361*a*. *Picus pubescens gairdneri.*
Dryobates borealis (Vieill.). 362. *Picus querulus.*
Dryobates scalaris. 363. *Picus scalaris.*
Dryobates scalaris lucasanus. 363*a*. *Picus scalaris lucasanus.*
Dryobates nuttalli. 364. *Picus nuttalli.*
Dryobates stricklandi. 365. *Picus stricklandi.*
Picoides americanus alascensis (Nels.). *Picoides tridactylus alascensis* Nelson, Auk, i, April, 1884, 165.
Melanerpes aurifrons. 373. *Centurus aurifrons.*
Melanerpes uropygialis. 374. *Centurus uropygialis.*
Trochilus alleni. 341. *Selasphorus alleni.*
Megascops asio trichopsis. 403. *Scops trichopsis.*
Accipiter atricapillus striatulus. 433*a*. *Astur atricapillus striatulus.*
Zenaida zenaida (Bonap.). 462. *Zenaida amabilis.*
Buteo butes. [435.] *Butes vulgaris.*
Syrnium nebulosum alleni. (*Strix nebulosa alleni*, Ridgw. Pr. U. S. Nat. Mus., iii, 1880, 8.)
Zenaidura macroura (Linn.). 460. *Zenaidura carolinensis* (Linn.).
Dendragapus obscurus fuliginosus. 471*a*. *Canace obscura fuliginosa.*
Dendragapus obscurus richardsoni. 471*b*. *Canace obscura richardsoni.*
Dendragapus canadensis. 472. *Canace canadensis.*
Dendragapus franklini. 472*a*. *Canace canadensis franklini.*
Bonasa umbellus togata (Linn.). (*Tetrao togatus*, Linn. S. N. ed. 12, I, 1766, 275.)
Tympanuchus pinnatus (Brewst.). 477. *Cupidonia cupido.* (*Cupidonia pinnata* Brewst., Auk, ii, Jan., 1885, 82.)
Tympanuchus cupido (Linn.). (*Cf.* Brewst., Auk, ii, Jan., 1885, pp. 80–84.
Tympanuchus pallidicinctus. 477*a*. *Cupidonia cupido pallidicincta.*
Callipepla californica vallicola, Ridgw. 482. *Lophortyx californica.* (NOTE.—*L. californicus brunnescens*, Ridgw. Pr. Biol. Soc. Washington, II, 1885, 94, is a synonym of *Tetrao californicus*, Shaw. The birds of this species from the interior valleys of California differ decidedly from those found along the west side of the coast range, being much less brown above, with the inner edges of the tertials light buff or buffy whitish, instead of rusty ochraceous. The coast bird being the true *Californica*, it becomes necessary to give a new name to that of the interior valleys, and the one above given has been selected as seemingly appropriate.
Ardea tricolor ruficollis (Gosse). 492. *Hydranassa tricolor ludoviciana.*
Branta canadensis occidentalis. 594*c*. *Bernicla canadensis occidentalis.*
Branta canadensis minima, Ridgw. 594*b*. *Bernicla canadensis leucopareia.* (*Bernicla minima*, Ridgw. Pr. U. S. Nat. Mus., viii, Apr. 20, 1885, 22.)
Netta rufina. 616. *Fuligula rufina.*

Aythya collaris. 616. *Fulix collaris.*
Oceanodroma homochroa. 725. *Cymochorea homochroa.*
Colymbus nigricollis californicus. 733*a*. *Dytes nigricollis californicus.*
Xanthocephalus xanthocephalus (Bp.). 260. *Xanthocephalus icterocephalus.*
Scolecophagus carolinus (Müll.). 273. *Scolecophagus ferrugineus.*
Empidonax fulvifrons pygmæus (Coues). 329. *Empidonax fulvifrons pallescens.*
Dendroica vigorsii (Aud.). 111. *Dendrœca pinus.*
Limosa limosa (Linn.). [546.] *Limosa ægocephala.*
Tryngites subruficollis (Vieill.) 556. *Tryngites rufescens.*
Grus mexicana (Müll.). 583. *Grus canadensis* (Linn.).
Tringa couesi. 531. *Arquatella couesi.*
Sula sula (Linn.). 652. *Sula leucogastra* (Bodd.).

A LIST OF THE ASTACIDÆ IN THE UNITED STATES NATIONAL MUSEUM.

By WALTER FAXON.

(Corrected to July 1, 1885.)

1. **Astacus fluviatilis** Rond.
   3229.* Central Germany.
   4137. Germany. 6♀.
   4134. Bohemia. Dr. Hessel. 4♂.
2. **Astacus pallipes** Lereb.
   10128. Montagny, Lake Neuchatel, Switzerland. Mus. Comp. Zoöl. 1♂, 1♀.
3. **Astacus torrentium** (Schrank) Wolf.
   4861. Bohemia.
4. **Astacus Gambelii** Ag.
   2536. Fort Hall, Idaho.
   3251. Teton Basin, Idaho.
   3227. Mouth of Yellowstone River.
   3249. Mouth of Yellowstone River.
   4396. Willow Creek [Wyoming Territory ?], Dr. Curtis, October 29, 1872. Young.
   4855. Santa Barbara, Cal. Dr. Webb. 6♂, 1♀.
5. **Astacus nigrescens** Stm.
   4974. San Francisco, Cal. Mus. Comp. Zoöl. 1♀.
   2267. California.
   2526. Fort Steilacoom, Wash. (Differs from the typical form. See Faxon, Revision of the Astacidæ).
   8954. Oonalaska, Alaska. W. H. Dall. 1♂.
6. **Astacus Trowbridgii** Stm.
   2080. Astoria, Oreg. Lieutenant Trowbridge. Types. 2♂, 2♀.
7. **Astacus leniusculus** Dana.
   2019. Columbia River. U. S. Explor. Exped. Type.
   2161. Locality unknown.
8. **Astacus Klamathensis** Stm.
   3881. Fort Walla Walla, Wash. Capt. Charles Bendire. 3♂, 2♀.
   4037. Fort Walla Walla, Wash. Capt. Charles Bendire. 8♂, 12♀.

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* These numbers refer to the catalogue of Crustacea of the National Museum, in which the specimens are registered.

3899. Fort Walla Walla, Wash. 4 ♂.
3568. Fort Walla Walla, Wash., 3 ♂, 12 ♀.
3559. Fort Walla Walla, Wash. ♂, ♀. 12 +.
9428. Fort Walla Walla, Wash. 2 ♂, 1 ♀.
3166. Sikan Creek, Oreg.
6673. Des Chutes River, Oreg.
2072. Locality unknown. 1 ♂, 3 ♀.
4862. Locality unknown.
5042.* Locality unknown.

9. **Cambarus Blandingii** (Harlan) Erichs.
3301. Kinston, N. C.
4148. Tarborough, N. C.
3220. Wilmington, N. C.
3572. Salmon Creek, N. C.
3381. Near Columbia, S. C. M. McDonald.

Cambarus Blandingii (Harlan) Erichs.?
4888. Montgomery, Ala.
4132. Montgomery, Ala.

10. **Cambarus Blandingii**, var. **acuta** Fax. (*C. acutus* Gir.)
5617. New Orleans, La.
5505. Louisiana.
3252. Tickfaw, La.
3255. Tangipahoa River, Amite, La. P. Maxson, December 22, 1876.
9315. Jackson Barracks, La. 1 ♂.
4949. Mobile, Ala.
4950. Mobile, Ala.
4951. Blount Spring and Cullman, Sand Mountain, Ala.
4491. Near Bridgeport, Jackson County, Ala.
4875. South of Decatur, Ala.
4127. Montgomery, Ala. Kumlein & Bean. 1 ♂.
5499. Wheatland, Ind.
3382. Wheatland, Ind. Robert Ridgway, April, May, 1881.
3221. Aux Plains, Ill.? 1 ♂.
4131. Illinois. G. W. Milner, 1876. 1 ♀.
2164. Locality unknown. 25 +.

Cambarus sp.
5619. New Orleans, La. Dr. Shufeldt.
9430. Arkadelphia, Ark. Jordan & Gilbert. 1 ♀.

11. **Cambarus fallax** Hag.
3182. Lake Jessup, Fla.
4382. Indian River, Fla.
3163. Near Titusville, Fla.
4969. Saint John's River, Fla. Mus. Comp. Zool. 2.

12. **Cambarus Clarkii** Gir.
5618. New Orleans, La.
3359. New Orleans, La. G. Dunbar's Sons. 3 ♂, 1 ♀.
2261. New Orleans, La. G. Kohn. 1 ♂, 2 ♀.
4859. New Orleans, La. Dr. R. W. Shufeldt, November 10, 1882. 1 ♀ with young.
5502. Louisiana. Dr. Shufeldt.
5507. Louisiana.
3253. Tangipahoa River, La. Frederick Mather, August, 1875.
4952. Ocean Springs, Miss.
4512. Pensacola, Fla. Silas Stearns, May 31, 1882. ♂, ♀. 12+.

13. Cambarus troglodytes (Le C.) Hag.
4885. Near Columbia, S. C.
4053. Oakley, S. C. F. W. Hayward. 1 ♂, 1 ♀.

14. Cambarus Lecontei Hag.
4958. Mobile, Ala. Type. Mus. Comp. Zool. 1 ♂.

15. Cambarus pubescens Fax.
3181. McBean Creek. Ga. A. Graves. Types. 1 ♂, 1 ♀.

16. Cambarus spiculifer (Le C.) Hag.
4962. Athens, Ga. Mus. Comp. Zoöl. 1 ♂.

17. Cambarus versutus Hag.
4963. Spring Hill, Ala. Type. Mus. Comp. Zoöl. 1 ♂.

18. Cambarus Wiegmanni Erichs.?
3288. Isthmus of Tehuantepec. Prof. Sumichrast. 1 ♀.

19. Cambarus pellucidus (Tellk.) Erichs.
4852. Mammoth Cave, Ky. Peter Parker, 1858. 1 ♂.
4970. Mammoth Cave, Ky. Mus. Comp. Zoöl. 1 ♀.
9314. White Cave, Ky. 3 ♀.

20. Cambarus simulans Fax.
4150. East of Canadian River. Types.
5500. Shoal Creek, near Austin, Tex.

21. Cambarus advena (Le C.) Hag.
4964. Georgia. Mus. Comp. Zoöl. 1 ♀.

22. Cambarus gracilis Bundy.
6672. Davenport, Iowa. Young.
4960. Decatur, Ill. Mus Comp. Zoöl. 1 ♂.

23. Cambarus Cubensis Erichs.
10129. Near Havana, Cuba. Mus. Comp. Zoöl. 1 ♂, 1 ♀.

24. Cambarus Bartonii (Fab.) Gir.
5624. Fulton Lakes, N. Y.
8949. Bainbridge, Penn.
3835. Carlisle, Penn.?
4863. Spring Creek, Caledonia.
4955. Rock Creek, D. C.
5621. Rock Creek, D. C.
3180. Rock Creek, D. C.
4620. Rock Creek, D. C.
4621. Rock Creek, D. C.
6670. Washington, D. C.
6669. Washington, D. C.
6668. Locality unknown.
5622. Clarke County, Va.
4128. Holston River, Smyth County, Va.
4886. Kinston, N. C.
9383. Doe River., Carter County, Tenn. H. Hemphill. Var. *longirostris* Fax. 3 ♀.

25. Cambarus Bartonii var. **robusta** Fax. (*Cambarus robustus* Gir.).
5623. Fulton Lakes, N. Y.
4961. Forestville, N. Y. Mus. Comp. Zoöl. 1 ♂.

Camburus sp.
4972. Mobile, Ala. Mus. Comp. Zoöl. 1 ♀.
5620. Milton, Fla.
4871. Near Ashland City, Tenn.

26. Cambarus latimanus (Le C.) Hag.
3374. South Carolina ? M. McDonald.
3145. Near Columbia, S. C.
4953. Blount Spring and Cullman, Ala.
4954. Ocean Springs, Miss.

Cambarus latimanus (Le C.) Hag. ?
4877. Waterloo, Lauderdale County, Ala. C. L. Herrick.
4874. Near Bridgeport, Jackson County, Ala.
4492. Near Ashland City, Cheatham County, Tenn.

27. Cambarus Diogenes Gir.
8946. Washington, D. C.
3225. Wilmington, N. C.
3298. Kinston, N. C.
5625. New Orleans, La.
5504. New Orleans, La.
3373. Knox County, Ind.
5492. Abingdon, Ill.
4973. Decatur, Ill. Mus. Comp. Zoöl. 1 ♂.
5501. Davenport, Iowa.
2163. Locality unknown.
2491. Locality unknown.

Cambarus Diogenes Gir. ?
4887. Kinston, N. C.
4883. South of Decatur, Ala.
2262. New Orleans, La.
4078. Panama. 1 young ♂.

28. Cambarus extraneus Hag.
4957. Tennessee River, near border of Georgia. Type. Mus. Comp. Zoöl. 1 ♀.

29. Cambarus Girardianus Fax.
4882. Cypress Creek, Lauderdale County, Ala. C. L. Herrick, October, 1882. Types.

30. Cambarus immunis Hag.
2323. White River, Ind.
3223. Aux Plains, Ill.
4866. Milwaukee, Wis. E. G. Blackford.
3222. Near Laramie, Wyo.
3257. Orizaba, Mexico.
3570. Locality unknown.

31. Cambarus immunis var. **spinirostris** Fax.
4655. Obion County, Tenn. Types.

32. Cambarus Palmeri Fax.
4872. Obion County, Tenn. Edw. Palmer, May 30, 1882. Types.
4654. Obion County, Tenn. Edw. Palmer, May 30, 1882. Types.

33. Cambarus Alabamensis Fax.
4876. Waterloo, Lauderdale County, Ala. C. L. Herrick. Types. ♂, ♀. 25+.

34. Cambarus compressus Fax.
4878. Waterloo, Lauderdale County, Ala. C. L. Herrick, October, 1882. Types.
4879. Cypress Creek, Lauderdale County, Ala. C. L. Herrick, October, 1882. Type

35. Cambarus affinis (Say) Gir.
- 8947. Bainbridge, Pa.
- 4853. Susquehanna River, Pa. F. G. Galbraith. 3 ♂.
- 3842. Bainbridge, Pa.
- 4126. Havre de Grace, Md.
- 4854. Havre de Grace, Md. T. H. Bean. ♂, ♀. 12+.
- 4904. Havre de Grace, Md. T. H. Bean.
- 2081. Potomac River, Washington, D. C. Types of *C. Pealei* Gir. 2 ♂, 2 ♀.
- 8952. Potomac River, Washington, D. C.
- 8951. Washington, D. C.
- 8953. Washington, D. C.
- 8955. Washington, D. C.
- 8945. Washington, D. C. 1 ♀.
- 8948. Washington, D. C. 1 ♂.
- 3248. District of Columbia.
- 4145. Potomac River, Gunston, Va.
- 4146. Potomac River, Gunston, Va.
- 4893. Potomac River, Gunston, Va. M. McDonald.
- 2265. Potomac River, Va. ♂, ♀, 12+.
- 8950. Locality unknown. 2 ♂, 1 ♀.

36. Cambarus Sloanii Bundy.
- 4965. New Albany, Ind. Mus. Comp. Zoöl. 2 ♂.

37. Cambarus propinquus Gir.
- 6671. Grass River, Canton, N. Y.
- 3226. Ogdensburgh, N. Y.
- 4959. Forestville, N. Y. Mus. Comp. Zoöl. 1 ♂.
- 2135. Rocky River.
- 4851. Illinois. G. W. Milner.
- 3250. Aux Plains River, Ill.
- 4149. Northville, Mich.
- 2160. Locality unknown.

38. Cambarus propinquus, var. **obscura**, Fax. (*Cambarus obscurus* Hag.)
- 4971. Genesee River, Rochester, N. Y. Type. Mus. Comp. Zoöl. 1 ♂.
- 2531. California (?).

39. Cambarus virilis Hag.
- 4865. Illinois.
- 4858. Historical Society, Manitoba.
- 4857. Cedar Lake, Hennepin County, Minn. C. L. Herrick.
- 4868. Cedar Lake, Hennepin County, Minn. C. L. Herrick.
- 4869. Lake Independence, Minn. C. L. Herrick.
- 4870. Bassett's Creek, Hennepin County, Minn. C. L. Herrick.
- 4856. Milwaukee, Wis. E. G. Blackford.
- 4900. Milwaukee, Wis. E. G. Blackford.
- 4153. Souris River, Dak. Elliott Coues, 1873.
- 4154. Souris River, Dak. Elliott Coues, 1873.
- 3256. Souris River, Dak. Elliott Coues, 1873.
- 2309. Souris River, Dak. Elliott Coues, 1873.
- 3154. Red River of the North, near Pembina, Dak. Elliott Coues, May, 1873. Types of *C. Couesi* Streets.
- 9429. Des Moines River, Iowa. Jordan & Gilbert. 5.
- 9431. Bedford, Iowa. Jordan & Meek. 1 ♀.
- 2068. Laramie, Wyo.
- 9427. White River, Eureka Springs, Ark. Jordan & Gilbert. 2 ♀.
- 4873. Near Bridgeport, Jackson County, Ala.

Cambarus sp.
4867. Cheatham's Ferry, Lauderdale County, Ala.

40. Cambarus rusticus Gir.
4968. Cincinnati, Ohio. One of Hagen's types. Mus. Comp. Zoöl. 1 ♂.
4966. Lebanon, Tenn. Type of *C. placidus* Hag. Mus. Comp. Zoöl. 1 ♂.
9427. White River, Eureka Springs, Ark. Jordan & Gilbert. 1 ♀.
4967. Kentucky River, Little Hickman, Ky. Type of *C. juvenilis* Hag. Mus. Comp. Zoöl. 1 ♂.

41. Cambarus spinosus Bundy.
4881. Cypress Creek, Lauderdale County, Ala. C. L. Herrick.

Cambarus sp.
4884. Georgia.

42. Cambarus Putnami Fax.
10130. Grayson Springs, Grayson County, Ky. Type. Mus. Comp. Zoöl. 1 ♂.

43. Cambarus forceps Fax.
4880. Cypress Creek, Lauderdale County, Ala. C. L. Herrick, October, 1882. Types.

44. Cambarus Montezumæ Saus.
4119. Lake San Roque, Trapuato, Mexico.
4864. Mexico.

45. Cambarus Shufeldtii Fax.
4860. Near New Orleans, La. Dr. R. W. Shufeldt, 1883. Types.

46. Cheraps Preissii Erichs. ?
4889. Sydney, Australia.

47. Parastacinæ, sp. nov.
4133. Colima, Mexico. J. Xantus.

A LIST OF THE FISHES KNOWN FROM THE PACIFIC COAST OF TROPICAL AMERICA, FROM THE TROPIC OF CANCER TO PANAMA.

By **DAVID S. JORDAN.**

Four hundred and seven species of fishes are now known to inhabit the waters of the Pacific coast of tropical America between Cape San Lucas and Panama. Our knowledge of these species is due chiefly to the studies of Dr. Gill, Dr. Günther, Dr. Steindachner, and Professors Jordan and Gilbert. Only a few collectors have given especial attention to the fish fauna of this region, but the work of these has in nearly all cases been of exceptional value.

The earliest extensive collections were made by Mr. John Xantus at Cape San Lucas, and later at Colima. The specimens obtained by Xantus comprise especially the fishes of the rock-pools. These were studied by Dr. Gill in 1862, and by Professor Gilbert and the writer in 1882. Many of the specimens collected by Xantus still remain unique.

The next collections were made in the bay of Panama, by Capt. John M. Dow, about 1862 to 1866. The first of these were sent to the Smithsonian Institution, where they were studied by Dr. Gill. Later, still

larger collections were sent by Captain Dow to the British Museum. These fishes, and others collected by Dr. Oscar Salvin about Chiapam, were made the subjects of several papers by Dr. Günther, and in 1869 they formed the basis of his general work on the fishes of Central America.

Still later, Dr. Franz Steindachner visited various points along the coast, making collections of fishes. Various local collectors have since sent specimens to the Vienna professor. His various treatises on the fishes of different regions contain many references to the fishes of the Pacific coast of tropical America, and a very large number of the species were first made known by him. The figures published by Dr. Steindachner are the best in ichthyological literature.

A very valuable collection was made by Professor Bradley in the vicinity of Panama in 1866, and by him sent to the museum of Yale College. Unfortunately this collection was allowed to suffer from neglect, and before it was finally studied by Dr. Gilbert and the writer in 1882, most of the species which were new to science when the collection was made had been already described.

Smaller collections have also been obtained by Dr. Bocourt, about La Union, by Dr. Streets, by Mr. Lockington, and by Mr. Belding, in the Gulf of California, and by Lieutenant Nichols at various points on the Mexican coast. The first named collection has formed the rather insufficient basis for an elaborate memoir by Professor Vaillant and Dr. Bocourt; the last mentioned has been studied by Dr. Gilbert and the writer.

The most extensive collections yet made on the Pacific coast of Mexico and Central America, in number of specimens exceeding all the others combined, are those obtained by Professor Gilbert at Mazatlan and Panama in 1881, and about Panama in 1883.

These collections have formed the subject of numerous papers by Professor Gilbert and the writer in the publications of the United States National Museum.

We had prepared a descriptive catalogue, giving the full synonymy and detailed descriptions of all the known species. In the fire which, in 1883, destroyed the museum of the Indiana University our manuscripts (then ready for the printer) were all burned, and with them about two-thirds of Professor Gilbert's entire collections. All the specimens obtained at Panama in 1883 were destroyed, but most of the collection of 1881 had then been returned to the National Museum.

Among the specimens destroyed were twenty species from Panama which still remain without names.

The present paper is the result of the joint studies of Professor Gilbert and the writer, but for its details the present writer is alone responsible.

I have given a list of the species ascribed on good authority to the region in question. Those species, three hundred and sixty-two in

number, of which specimens have been examined by the writer are indicated by a star (*). Those species, seventy-one in number, which appear to be common to both the Atlantic and Pacific coasts of tropical America are indicated by the dagger (†). Those actually collected at Mazatlan by Professor Gilbert, one hundred and seventy-two in number, are indicated by the letter "*M*"; "*P*" indicates those obtained by Professor Gilbert at Panama. Of these there are about one hundred and eighty. The other references explain themselves.

Family 1.—BRANCHIOSTOMIDÆ.

1. BRANCHIOSTOMA Costa.

1. **Branchiostoma lanceolatum** † Pallas.
   Angel Island, Gulf of California (*Lockington*).

Family 2.—SCYLLIIDÆ.

2. GINGLYMOSTOMA Müller & Henle.

2. **Ginglymostoma cirratum** * † Gmelin. *M.*, *P.*
3. **Ginglymostoma fulvum** * † Poey. *P.*
   (Doubtful species.)

Family 3.—GALEORHINIDÆ.

3. GALEUS Rafinesque.

4. **Galeus lunulatus** * Jordan & Gilbert. *M.*
5. **Galeus dorsalis** * Gill. *P.*
   Panama (*Gill*).

4. GALEOCERDO Müller & Henle.

6. **Galeocerdo maculatus** * † Ranzani. *M.*
   San José (*Gilbert*).

5. CARCHARHINUS Blainville.

7. **Carcharhinus longurio** * Jordan & Gilbert. *M.*, *P.*
8. **Carcharhinus limbatus** † Müller & Henle.
   Chiapam (*Gthr.*) (?).
9. **Carcharhinus æthalorus** * Jordan & Gilbert. *M.*, *P.*
10. **Carcharhinus** * sp. indescr.[1] *P.*
11. **Carcharhinus fronto** * Jordan & Gilbert. *M.*

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[1] This species and others similarly indicated belong to Professor Gilbert's collection of 1883. These were destroyed by fire before the publication of descriptions of them as new species.

Family 3.—SPHYRNIDÆ.

6. SPHYRNA Rafinesque.

12. Sphyrna tudes* Cuvier. *M.*

13. Sphyrna zygæna* † Linnæus. *M., P.*

Family 4.—PRISTIDIDÆ.

7. PRISTIS Latham.

14. Pristis perrotteti* Müller & Henle. *M.*
Chiapam (*Günther*).

Family 5.—RHINOBATIDÆ.

8. RHINOBATUS Bloch & Schneider.

15. Rhinobatus glaucostigma* Jordan & Gilbert. *M.*
Gulf of California (*Streets*).

16. Rhinobatus leucorhynchus* Günther. *P.*
Panama (*Gthr.*).

17. Rhinobatus exasperatus* Jordan & Gilbert.
Panama (*Bradley*).

Family 6.—TORPEDINIDÆ.

9. NARCINE Henle.

18. Narcine,* sp. indescr. *P.*

10. DISCOPYGE Tschudi.

19. Discopyge,* sp. indescr. *P.*

Family 7.—TRYGONIDÆ.

11. UROLOPHUS Müller & Henle.

20. Urolophus mundus* Gill. *P.*
Panama (*Gill*).

21. Urolophus asterias* Jordan & Gilbert. *M., P.*

22. Urolophus aspidurus* Jordan & Gilbert. *P.*

23. Urolophus nebulosus Garman.
Colima (*Xantus*).

24. Urolophus halleri* Cooper. *M., P.*
Panama (*Bradley*).

12. DASYBATIS Rafinesque.

25. Dasybatis longus* Garman. *M.*
Acapulco, Panama (*Garman*).

13. PTEROPLATEA Müller & Henle.

26. Pteroplatea crebripunctata * Peters. *M.*
Mazatlan (*Peters*).

14. AËTOPLATEA Müller & Henle.

27. Aëtoplatea,* sp. indescr. *P.*

Family 8.—MYLIOBATIDÆ.

15. STOASODON Cantor.

28. Stoasodon laticeps * Gill. *M.*

Family 9.—CERATOPTERIDÆ.

16. MANTA Bancroft.

29. Manta birostris † Walbaum.
(*Brachioptilon hamiltoni* Newman.)
Gulf of California (*Newman; Streets*).

Family 10.—SILURIDÆ.

17. ÆLURICHTHYS Baird & Girard.

30. Ælurichthys pinnimaculatus * Steindachner. *M., P.*
Altata, Costa Rica, Panama (*Steind.*); Panama (*Rowell*).

31. Ælurichthys panamensis * Gill.
(*Ælurichthys nuchalis* Gthr.) *M., P.*
Libertad, Punta Arenas (*Gilbert*); Panama (*Gill; Gthr.*); Magdalena Bay, Altata, Panama (*Steind.*).

18. GALEICHTHYS Cuvier & Valenciennes.

32. Galeichthys peruvianus * Lütken. *P.*
Callao (*Lütken*); Altata, Panama (*Steind.*).

33. Galeichthys,* sp. indescr. *P.*

34. Galeichthys arioides Kner.
(*Arius multiradiatus* Günther.)
Rio Bayano, Panama (*Kner.*).

35. Galeichthys dowi * Gill. *P.*
(*Arius alatus* Steind.)
Panama (*Gill; Bradley*); Panama, Guayaquil (*Steind.*).

36. Galeichthys brandti * Steindachner. *M., P.*
Panama, Altata (*Steind.*); Punta Arenas (*Gilbert*).

37. Galeichthys kessleri * Steindachner. *P.*
Altata, Panama (*Steind.*).

38. **Galeichthys insculptus** * Jordan & Gilbert. *P.*

39. **Galeichthys planiceps** * Steindachner. *P.*

Altata, Panama (*Steind.*).

40. **Galeichthys troscheli** Gill.

Panama (*Gill*).

41. **Galeichthys** * sp. indescr. *P.*

42. **Galeichthys platypogon** * Günther. *M.*, *P.*

Libertad, Punta Arenas (*Gilbert*); San José (*Gthr.*); Magdalena Bay, Callao (*Steind.*).

43. **Galeichthys elatturus** * Jordan & Gilbert. *P.*

44. **Galeichthys osculus** * Jordan & Gilbert. *P.*

45. **Galeichthys seemani** * Günther. *M.*

Altata (*Steind.*); Panama (*Steind.*).

46. **Galeichthys cœrulescens** Günther.

Rio Huamuchal (*Gthr.*).

47. **Galeichthys guatemalensis** * Günther. *M.*

Chiapam (*Gthr.*); Colima (*Xantus*).

48. **Galeichthys dasycephalus** * Günther. *P.*

Panama (*Steind.*).

49. **Galeichthys fürthi** * † Steindachner. *P.*

Panama (*Steind.*).

50. **Galeichthys melanopus** * Günther. *P.*

Rio Motagua (*Gthr.*); Panama (*Steind.*).

51. **Galeichthys hypophthalmus** * Steindachner. *P.*

Panama (*Steind.*).

Family 11.—CLUPEIDÆ.

19. CLUPEA Linnæus.

52. **Clupea thrissina** * Jordan & Gilbert.

Cape San Lucas (*Xantus*).

53. **Clupea stolifera** * Jordan & Gilbert. *M.*, *P.*

20. OPISTHONEMA Gill.

54. **Opisthonema libertate** * Günther. *M.*, *P.*

Libertad (*Günther*).

21. OPISTHOPTERUS Gill.

55. **Opisthopterus lutipinnis** * Jordan & Gilbert. *M.*

56. **Opisthopterus dovii** * Günther. *P.*

Panama (*Günther*).

57. **Opisthopterus macrops** Günther.

Panama (*Gthr.*).

22. ODONTOGNATHUS Lacépède.

58. Odontognathus panamensis * Steindachner. *P.*
Panama (*Steind*).

23. PELLONA Cuvier & Valenciennes.

59. Pellona panamensis * Steindachner. *P.*
Panama, Guayaquil (*Steind*).

60. Pellona fürthi * Steindachner. *P.*
Punta Arenas (*Gilbert*). Panama (*Steind*).

Family 12.—ENGRAULIDIDÆ.

24. STOLEPHORUS Lacépède.

61. Stolephorus macrolepidotus * Kner & Steindachner. *M.*, *P.*
Rio Bayano (*Kner & Steind.*); Panama (*Steind.*).

62. Stolephorus panamensis * Steindachner. *P.*
Panama (*Steind.*).

63. Stolephorus poeyi * Kner & Steindachner. *P.*
Rio Bayano (*Kner & Steind.*).

64. Stolephorus spinifer † Cuv. & Val.
Panama (*Steind.*).

65. Stolephorus opercularis * Jordan & Gilbert.
Gulf of California (*Nichols*).

66. Stolephorus lucidus * Jordan & Gilbert. *M.*

67. Stolephorus ischanus * Jordan & Gilbert. *M.*

68. Stolephorus curtus * Jordan & Gilbert. *M.*

69. Stolephorus exiguus * Jordan & Gilbert. *M.*

70. Stolephorus miarchus * † Jordan & Gilbert. *M.*
Pearl Islands (*Bradley*).

71. Stolephorus ringens Jenyns.
California; Peru; Chili; (not in Central America?)

72. Stolephorus,* sp. indescr. *P.*

25. CETENGRAULIS Günther.

73. Cetengraulis mysticetus Günther.
Panama (*Gthr.*).

Family 13.—ALBULIDÆ.

26. ALBULA Gronow.

74. Albula vulpes *† Linnæus. *M.*, *P.*

Family 14.—ELOPIDÆ.

27. ELOPS Linnæus.

75. **Elops saurus** * † L. *M.*, *P.*

Family 15.—CHANIDÆ.

28. CHANOS Lacépède.

76. **Chanos chanos** * Forskål. *M.*
Chiapam (*Gthr.*).

Family 16.—SYNODONTIDÆ.

29. SYNODUS Bloch & Schneider.

77. **Synodus scituliceps** * Jordan & Gilbert. *M.*, *P.*

Family 17.—CYPRINODONTIDÆ.

30. CHARACODON Günther.

78. **Characodon furcidens** * Jordan & Gilbert.
Cape San Lucas (*Xantus*).

31. FUNDULUS Lacépède.

79. **Fundulus punctatus** Günther.
Chiapam (*Gthr.*).

80. **Fundulus guatemalensis** Günther.
Rio Guacalate (*Gthr.*).

81. **Fundulus pachycephalus** Günther.
Lake Atitlan (*Gthr.*).

82. **Fundulus vinctus** * Jordan & Gilbert.
Cape San Lucas (*Xantus*).

83. **Fundulus extensus** * Jordan & Gilbert.
Cape San Lucas (*Xantus*).

32. HAPLOCHILUS McClelland.

84. **Haplochilus dovii** Günther.
Punta Arenas (*Günther*).

33. ANABLEPS Bloch.

85. **Anableps dovii** * Gill.
La Union (*Dow*); Chiapam (*Gthr.*).

34. PŒCILIA Bloch. & Schneider.

86. **Pœcilia elongata** * Günther. P.
Panama (*Gthr.*).

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Family 18.—MURÆNIDÆ.

35. MURÆNOBLENNA Lacépède.

87. Murænoblenna nectura * Jordan & Gilbert.

Cape San Lucas (*Xantus*).

36. MURÆNA Linnæus.

88. Muræna pinta * Jordan & Gilbert. *M.*

Cape San Lucas (*Xantus*); Colima (*Xantus*); Panama (*Rowell*); San Josef Island (*Nichols*).

89. Muræna melanotis * † Kaup.

Panama (*Günther*, *Bradley*).

37. SIDERA Kaup.

90. Sidera ocellata † Agassiz.

Panama (*Gthr.*) (?)

91. Sidera dovii * Gunther. *M.*

(*Murœna pintita* Jordan & Gilbert.)

Espiritu Santo (*Belding*); Galapagos Islands (*Herendeen*); Panama (*Gthr.*).

92. Sidera castanea * Jordan & Gilbert. *M.*

93. Sidera verrilli * Jordan & Gilbert.

Panama (*Bradley.*)

94. Sidera panamensis * Steindachner.

Panama (*Steind.*); Pearl Island (*Bradley*).

95. Sidera aquæ-dulcis Cope.

San José (*Cope*).

38. ECHIDNA Forster.

(*Pœcilophis* Kaup.)

96. Echidna nocturna Cope.

San José (*Cope*)

Family 19.—CONGRIDÆ.

39. ICHTHYAPUS Barneville.

97. Ichthyapus selachops * Jordan & Gilbert.

Cape San Lucas (*Xantus*).

40. OPHISURUS Lacépède.

98. Ophisurus xysturus * Jordan & Gilbert. *M.*

Mazatlan, Acapulco, Panama (*Bradley*).

41. OPHICHTHYS Ahl.

99. **Ophichthys miurus** * Jordan & Gilbert.

Cape San Lucas (*Xantus*).

100. **Ophichthys triserialis** * Kaup. *M.*

(*Ophisurus californiensis* Garrett; *Herpetoichthys callisoma* Abbott).

"Pacific" (*Kaup*); Cape San Lucas (*Nichols*); Pacific (*Abbott*); Lower California (*Garrett*).

101. **Ophichthys zophochir** * Jordan & Gilbert. *M.*

Acapulco (*Sutter*).

42. MYROPHIS Lütken.

102. **Myrophis vafer** * Jordan & Gilbert. *P.*

Panama (*Gthr.*); Guaymas (*Emeric*).

43. MURÆNESOX McClelland.

103. **Murænesox coniceps** * Jordan & Gilbert. *M.*, *P.*

44. CONGER Cuvier.

104. **Conger conger** * † Linnæus.

Cape San Lucas (*Belding*).

Family 20.—BELONIDÆ.

45. TYLOSURUS Cocco.

105. **Tylosurus hians** † Cuv. & Val.

Acapulco (*Steind.*).

106. **Tylosurus fodiator** * Jordan & Gilbert. *M.*

107. **Tylosurus pacificus** * Steindachner. *P.*

Panama, Acapulco (*Steind.*); Panama (*Bradley*).

108. **Tylosurus scapularis** * Jordan & Gilbert. *P.*

109. **Tylosurus**, sp. indescr * *P.*

110. **Tylosurus stolzmanni** * Steindachner. *M.*, *P.*

(*Tylosurus sierrita* Jordan & Gilbert.)

Peru (*Steind.*).

Family 21.—SCOMBERESOCIDÆ.

46. HEMIRHAMPHUS Cuvier.

111. **Hemirhamphus roberti** † * Cuv. & Val. *M.*, *P.*

Gulf of California (*Nichols*); Panama (*Bradley*).

112. **Hemirhamphus unifasciatus** † * Ranzani.

Panama (*Dow.*).

113. **Hemirhamphus balao** * † Le Sueur. *P.*

Panama (*Bradley*).

47. FODIATOR Jordan & Meek.

114. Fodiator acutus * Cuv. & Val.

Panama (*Ruschenberger*).

48. EXOCŒTUS Linnæus.

115. Exocœtus rufipinnis * † Cuv. & Val.
(*Exocœtus dowi* Gill.)

Panama (*Gill.*); Payta (*C. & V.*).

116. Exocœtus californicus * Cooper.

Near Cape San Lucas (*Gilbert*).

117. Exocœtus callopterus * Günther. *P.*

Panama (*Gthr.; Lütken*).

Family 22.—SYNGNATHIDÆ.

49. DORYRHAMPHUS Kaup.

118. Doryrhamphus californiensis Gill.

Cape San Lucas (*Xantus*).

50. HIPPOCAMPUS Linnæus.

119. Hippocampus ingens * Girard. *M.*
(*Hippocampus gracilis* Gill.)

San Diego (*Girard*); Cape San Lucas (*Gill*).

Family 23.—FISTULARIIDÆ.

51. FISTULARIA Linnæus.

120. Fistularia depressa * Gthr. *M.*

Lower California. (*Gthr.*).

Family 24.—MUGILIDÆ.

52. MUGIL Linnæus.

121. Mugil cephalus † * L. *M., P.*

Acapulco (*Steind.*); Punta San Ygnacio (*Nichols*); California, Chili, &c.

122. Mugil incilis * † Hancock.

Chiapam (*Steind.*); Panama (*Bradley*).

123. Mugil curema * † Cuv. & Val. *M., P.*

Everywhere.

124. Mugil,* sp. indescr. *P.*

53. CHÆNOMUGIL Gill.

125. Chænomugil proboscideus * Günther. *M., P.*

54. **QUERIMANA** Jordan & Gilbert

126. **Querimana harengus** * Günther. *M.*, *P.*
Panama (*Günther*); Zorritas (*Bradley*).

Family 25.—ATHERINIDÆ.

55. **MENIDIA** Bonaparte.

127. **Menidia pachylepis** * Günther. *P.*
Panama (*Gthr.*).

128. **Menidia guatemalensis** Günther.
L. Huamuchal (*Gthr.*).

129. **Menidia,*** sp. indescr.

56. **ATHERINA** Linnæus.

130. **Atherina eriarcha** * Jordan & Gilbert. *M.*
Peru.

57. **ATHERINELLA** Steindachner.

131. **Atherinella panamensis** Steindachner.
Panama (*Steind.*).

Family 26.—SPHYRÆNIDÆ.

58. **SPHYRÆNA** Bloch.

132. **Sphyræna argentea** * Girard.
(*Sphyræna lucasana* Gill.)
Cape San Lucas (*Xantus*); California.

133. **Sphyræna ensis** * Jordan & Gilbert. *M.*, *P.*
San Bartholomé Bay (*Steind.*); Panama (*Steind.*).

Family 27.—POLYNEMIDÆ.

59. **POLYNEMUS** Linnæus.

134. **Polynemus approximans** * Lay & Bennett. *M.*, *P.*
Common.

135. **Polynemus opercularis** * Gill. *M.*, *P.*
(*Polynemus melanopoma* Günther.)
Common.

Family 28.—ECHENEIDIDÆ.

60. **REMORA** Gill.

136. **Remora remora** * † Linnæus. *P.*

137. **Remora albescens** * † Temminck & Schlegel.
La Paz (*Streets*).

Family 29.—TRICHIURIDÆ.

61. TRICHIURUS Linnæus.

138. Trichiurus lepturus * † L.

Gulf of California (*Streets*).

62. LEPIDOPUS Gouan.

139. Lepidopus caudatus * Euphrasen.

Cape San Lucas (*Xantus*).

Family 30.—SCOMBRIDÆ.

63. SCOMBER Linnæus.

140. Scomber colias * † Gmelin.

Cape San Lucas (*Xantus*).

64. SCOMBEROMORUS Lacépède.

141. Scomberomorus maculatus * † Mitchill. *M.*, *P.*

65. SARDA Cuvier.

142. Sarda chilensis Cuv. & Val.

66. ORCYNUS Cuvier.

143. Orcynus alalonga † Gmelin.

Near Mazatlan (*Lay & Bennett*).

Family 31.—CARANGIDÆ.

67. DECAPTERUS Bleeker.

144. Decapterus macarellus * † Cuv. & Val.
(*Decapterus hypodus* Gill.)

Cape San Lucas (*Xantus*).

68. TRACHURUS Rafinesque.

145. Trachurus picturatus * † Bowdich.

Cape San Lucas (*Xantus*).

146. Trachurus trachurus * † Linnæus.

Cape San Lucas (*Xantus*).

69. TRACHUROPS Gill.

147. Trachurops crumenophthalmus * † Bloch.
(*Trachurops brachychirus* Gill.)

Cape San Lucas (*Xantus*).

70. CARANX Lacépède.

148. **Caranx atrimanus** * Jordan & Gilbert. *P.*

149. **Caranx vinctus** * Jordan & Gilbert. *M.*

San Blas (*Lay & Bennett*); Punta Arenas (*Gilbert*).

150. **Caranx leucurus** * Günther.

(*Caranx fürthi* Steindachner.)

Panama (*Gthr.; Steind.*).

151. **Caranx chrysus** † **caballus** * Günther.[1] *M., P.*

(*Caranx boöps* Girard; *Caranx girardi* Steind.)

Common.

152. **Caranx latus** * † Agassiz. *M., P.*

(*Carangus marginatus* Gill.)

Common.

153. **Caranx hippos** * † Linnæus. *M., P.*

Common.

154. **Caranx lugubris** * † Poey.

Clarion Islands (*Nichols*).

155. **Caranx melampygus** * Cuv. & Val.

Socorro Island (*Nichols*).

156. **Caranx speciosus** * Forskål. *M., P.*

(*Caranx panamensis* Gill.)

Panama (*Gill; Gthr.*).

157. **Caranx orthogrammus** * Jordan & Gilbert.

Clarion Island (*Nichols*).

158. **Caranx dorsalis** * Gill. *M., P.*

Panama (*Gthr.; Gill*).

159. **Caranx crinitus** * † Mitchill. *M.*

Cape San Lucas (*Xantus*).

71. VOMER Cuvier.

160. **Vomer setipinnis** * † Mitchill. *M., P.*

Common.

72. SELENE Lacépède.

161. **Selene œrstedi** * Lütken. *M., P.*

Punta Arenas (*Lütken*).

162. **Selene vomer** * † Linnæus. *M., P.*

(*Argyriosus brevoorti* Gill; *Argyriosus pacificus* Lockington.)

Common.

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[1] Specimens of *Caranx chrysus*, which I cannot distinguish from the West Coast *caballus* occur, at Key West. Probably the two forms *chrysus* and *caballus* will prove to be undistinguishable.

73. CHLOROSCOMBRUS Girard.

163. **Chloroscombrus chrysurus** † **orqueta** * Jordan & Gilbert. *P.*
Magdalena Bay (*Steind*).

74. TRACHYNOTUS Lacépède.

164. **Trachynotus carolinus** * † Linnæus.
Cape San Lucas (*Xantus*)?

165. **Trachynotus rhodopus** * † Gill.
Cape San Lucas (*Xantus*)?

166. **Trachynotus kennedyi** * Steindachner. *M.*, *P.*
Magdalena Bay (*Steind.*); Lower California (*Lockington*).

167. **Trachynotus fasciatus** * Gill. *M.*, *P.*
(*Trachynotus glaucoides* Gthr.)
Cape San Lucas (*Xantus*); Porto Escondido (*Nichols*); San José, Panama (*Gthr.*).

75. SERIOLA Cuvier.

168. **Seriola dorsalis** * Gill.
Cape San Lucas (*Xantus*).

169. **Seriola mazatlana** Steindachner.
Mazatlan (*Steind.*). (Doubtful species).

76. NEMATISTIUS Gill.

170. **Nematistius pectoralis** * Gill. *M.*
Cape San Lucas (*Gill*); Magdalena Bay (*Steind.*); Picheluogo (*Nichols*).

77. OLIGOPLITES Gill.

171. **Oligoplites altus** * Günther. *M.*, *P.*
Panama (*Gthr.*).

172. **Oligoplites saurus** * † Bloch & Schneider. *M.*, *P.*
(*Oligoplites inornatus* Gill.)

Family 32.—STROMATEIDÆ.

78. STROMATEUS Linnæus.

173. **Stromateus medius** * Peters. *P.*
Mazatlan (*Peters*).

Family 33.—HOLOCENTRIDÆ.

79. HOLOCENTRUM Bloch.

174. **Holocentrum suborbitale** * Gill. *M.*, *P.*
Cape San Lucas (*Xantus*); Panama (*Dow*).

80. MYRIPRISTIS Cuvier.

175. Myripristis occidentalis * Gill.
(? *Rhamphoberyx leucopus* Gill.)

La Paz (*Harford*); Cape San Lucas (*Gill*).

176. Myripristis pœcilopus * Gill.

Cape San Lucas (*Xantus*). (Doubtful species.)

Family 34.—CENTROPOMIDÆ.

81. CENTROPOMUS Lacépède.

177. Centropomus undecimalis * † Bloch. *M.*, *P.*
(*Centropomus viridis* Lockington.)

Common.

178. Centropomus nigrescens * Günther. *M.*, *P.*

Chiapam (*Gthr.*); Punta Arenas (*Gilb.*).

179. Centropomus pedimacula * † Poey. *M.*, *P.*
(*Centropomus medius* Gthr.)

Chiapam (*Gthr.*); San Blas (*Nichols*); Punta Arenas (*Gilb.*).

180. Centropomus unionensis * Bocourt. *P.*

La Union (*Bocourt*).

181. Centropomus robalito * Jordan & Gilbert. *M.*, *P.*

182. Centropomus armatus * Gill. *P.*

Panama (*Gill*); Chiapam (*Gthr.*).

Family 35.—SERRANIDÆ.

82. SERRANUS Cuvier.

183. Serranus radialis * † Quoy & Gaimard. *M.*, *P.*
(*Centropristis macropomus* Gthr.)
(*Centropristis ayresi* Steind.)

Gulf of California (*Streets*, *Nichols*); Panama (*Gthr.*); Panama, Rio Janeiro, Santos (*Steind.*).

184. Serranus calopteryx * Jordan & Gilbert. *M.*

(*Prionodes fasciatus* Jenyns; preoccupied.)

Pearl Islands (*Bradley*); Galapagos Islands (*Jenyns*).

185. Serranus albomaculatus Jenyns.

Galapagos Islands (*Jenyns*, *Steind.*); Panama (*Steind.*).

186. Serranus maculofasciatus * Steindachner. *M.*

Mazatlan (*Steind.*).

83. HYPOPLECTRUS Gill.

187. Hypoplectrus lamprurus * Jordan & Gilbert. *P.*

84. ANTHIAS Bloch.

188. Anthias multifasciatus * Gill.

Cape San Lucas (*Xantus*).

85. PARANTHIAS Guichenot.

189. Paranthias furcifer * Cuv. *P.*

(*Brachyrhinus creolus* Gill; *Serranus colonus* Val.)

Cape San Lucas (*Xantus*); Galapagos Islands (*Val.*, *Steind.*); Panama (*Steind.*).

86. MYCTEROPERCA Gill.

190. Mycteroperca rosacea * Streets. *M.*

Gulf of California (*Streets*).

87. PROMICROPS Gill.

191. Promicrops itaiara † * Lichtenstein. *M.*, *P.*

(*Serranus quinquefasciatus* Bocourt.)

Punta Arenas (*Gilb.*); Tauesco (*Boc.*).

88. EPINEPHELUS Bloch.

192. Epinephelus sellicauda * Gill. *M.*, *P.*

(*Epinephelus ordinatus* Cope.)

Socorro Island (*Nichols*); Cape San Lucas, Colima (*Xantus*); Panama (*Gthr.*, *Steind.*, *Cope*).

193. Epinephelus analogus * Gill. *M.*, *P.*

(*Serranus courtadéi* Bocourt.)

Acapulco (*Nichols*); La Union (*Boc.*); Acapulco, Mazatlan, Panama (*Steind.*); Panama (*Gthr.*).

89. ALPHESTES Bloch & Schneider.

194. Alphestes multiguttatus * Günther. *M.*, *P.*

Panama (*Gthr.*).

90. ENNEACENTRUS Gill.

195. Enneacentrus panamensis Steindachner.

Panama (*Steind.*).

91. DERMATOLEPIS Gill.

196. Dermatolepis punctatus * Gill. *M.*

Cape San Lucas (*Xanthus*); Socorro Island (*Nichols*).

Family 36.—RHYPTICIDÆ

92. RHYPTICUS.

197. Rhypticus xanti * Gill. *M.*

Cape San Lucas (*Xantus*).

198. **Rhypticus nigripinnis*** Gill. *P.*
(*Rhypticus maculatus* Gill. = *Promicropterus decoratus* Gill.)
Cape San Lucas (*Xantus*); Panama (*Rowell*, *Gthr.*).

Family 37.—LOBOTIDÆ.

93. LOBOTES Cuvier.

199. **Lobotes surinamensis*** Bloch. *P.*
Panama (*Steind.*).

Family 38.—SPARIDÆ.

94. XENICHTHYS Gill.

200. **Xenichthys xanti*** Gill. *P.*
(*Xenichthys xenops* Jordan & Gilbert.)
Cape San Lucas (*Xantus*).

95. XENISTIUS Jordan & Gilbert.

201. **Xenistius californiensis*** Steindachner.
Cerros Island (*Streets*, *Nichols*); San Diego (*Steind.*).

96. HOPLOPAGRUS Gill.

202. **Hoplopagrus güntheri*** Gill. *M.*
Cape San Lucas (*Xantus*); Altata (*Steind.*).

97. LUTJANUS Bloch.

203. **Lutjanus argentiventris*** Peters. *M.*, *P.*
Mazatlan (*Peters*); Acapulco (*Nichols*).

204. **Lutjanus,*** sp. indescr. *P.*

205. **Lutjanus novemfasciatus*** Gill. *M. P.*
(*Lutjanus pacificus* Bocourt; *Lutjanus prieto* Jordan & Gilbert.)
Punta Arenas (*Gilb.*); Tauesco (*Boc.*); Cape San Lucas (*Xantus*); San Blas (*Nichols*).

206. **Lutjanus guttatus*** Steindachner. *M. P.*
Mazatlan (*Steind.*).

207. **Lutjanus colorado*** Jordan & Gilbert. *M.*
Punta Arenas (*Gilb.*).

208. **Lutjanus aratus*** Günther. *M.*, *P.*
Punta Arenas (*Gilb.*); Chiapam, Panama (*Gthr.*).

209. **Lutjanus inermis*** Peters.
Mazatlan (*Peters*).

98. CONODON Cuv. & Val.

210. Conodon serrifer * Jordan & Gilbert.
Boca Soledad, Gulf of California (*Streets*).

99. ORTHOPRISTIS Girard.

211. Orthopristis inornatus * Gill.
Cape San Lucas (*Xantus*).

212. Orthopristis brevipinnis * Steindachner.
Mazatlan (*Steind.*); Panama (*Bradley*).

213. Orthopristis cantharinus * Jenyns.
Guaymas (*Nichols*); Galapagos Island (*Jenyns*).

214. Orthopristis chalceus * Günther. *M.*, *P.*
(*Pristipoma Kneri* Steind.)
Mazatlan (*Steind*); Panama (*Gthr.*).

100. POMADASYS Lacépède.

215. Pomadasys leuciscus* Günther. *M.*, *P.*
San José, Chiapam, Panama (*Gthr.*).

216. Pomadasys elongatus * Steindachner. *M.*, *P.*
Panama (*Steind.*); Punta Arenas (*Gilb*).

217. Pomadasys nitidus * Steindachner. *M.*, *P.*
Mazatlan (*Steind*).

218. Pomadasys axillaris * Steindachner. *M.*
Mazatlan (*Steind.*); Lower California (*Streets*).

219. Pomadasys panamensis * Steindachner. *M.*, *P.*
Panama (*Steind,*).

220. Pomadasys branicki * Steindachner. *M.*, *P.*
Tumbez (*Steind.*).

221. Pomadasys macracanthus * Günther. *M.*, *P.*
Mazatlan (*Steind.*); Punta Arenas (*Gilb.*); Chiapam (*Gthr.*).

222. Pomadasys humilis * Kner & Steindachner.
Rio Bayano (*Kner & Steind.*); Rio Bayano (*Dow*).

101. ANISOTREMUS Gill.

223. Anisotremus dovii * Günther. *M.*, *P.*
Panama (*Gthr.*).

224. Anisotremus pacifici * Günther. *P.*
Panama (*Steind.*); Chiapam (*Gthr.*).

225. Anisotremus cæsius * Jordan & Gilbert. *M.*

226. Anisotremus interruptus * Gill.

Pristipoma fürthi Steind.). *M., P.*

Cape San Lucas (*Xantus*); Panama, &c. (*Steind.*).

227. Anisotremus virginicus † **tæniatus** * Gill. *M., P.*

Magdalena Bay (*Steind.*); Panama (*Dow*).

102. HÆMULON Cuvier.

228. Hæmulon maculicauda * Gill. *P.*

(*Hæmulon mazatlanum* Steind.).

Cape San Lucas (*Xantus*); Mazatlan, Acapulco (*Steind.*); Colima (*Xantus*).

229. Hæmulon flavoguttatum * Gill. *M., P.*

(*Hæmulon margaritiferum* Gthr.)..

Mazatlan, Acapulco, Altata, Panama (*Steind.*); Lower California (*Streets*); Cape San Lucas (*Xantus*); Panama (*Gthr.*).

230. Hæmulon steindachneri * † Jordan & Gilbert. *M., P.*

(*Hæmulon caudimacula* Steind., not C. & V.)

Acapulco (*Steind.*); Cape San Lucas, Colima (*Xantus*); Brazil (*Steind.*).

231. Hæmulon scudderi * Gill. *M., P.*

(*Hæmulon brevirostrum* Gthr.; *Hæmulon undecimale* Steind.)

Cape San Lucas (*Xantus*); Panama (*Gthr.*); Acapulco, Panama (*Steind.*).

232. Hæmulon sexfasciatum * Gill. *M., P.*

(*Hæmulon maculosum* Peters.)

Cape San Lucas, Colima (*Xantus*); Mazatlan (*Peters*).

103. CALAMUS Swainson.

233. Calamus brachysomus * Lockington. *M.*

Gulf of California (*Lock.; Nichols*); Panama (*Gthr.*).

104. GIRELLA Gray.

234. Girella nigricans * Ayres.

(*Girella dorsimacula* Gill.)

Cape San Lucas (*Xantus*); California.

105. KYPHOSUS Lacépède.

235. Kyphosus analogus * Gill. *M., P.*

(*Pimelepterus elegans* Peters.)

Cape San Lucas (*Xantus*); Mazatlan (*Peters*); Porto Escondido (*Nichols*); Chiapam, Panama (*Gthr.*).

236. Kyphosus lutescens * Jordan & Gilbert.

Socorro Island (*Nichols*).

237. Kyphosus ocyurus * Jordan & Gilbert. *P.*

Family 39.—CIRRHITIDÆ.

106. CIRRHITES Lacépède.

238. Cirrhites rivulatus* Valenciennes. *M.*

(*Cirrhites betaurus* Gill.)

Cape San Lucas (*Xantus*); Galapagos Islands (*Val.*).

Family 40.—APPOGONIDÆ.

107. APOGON Lacépède.

239. Apogon retrosella* Gill.

Cape San Lucas (*Xantus*).

240. Apogon dovii* Günther. *M., P.*

Panama (*Gthr.*).

Family 41.—MULLIDÆ.

108. UPENEUS Cuvier.

241. Upeneus grandisquamis,* Gill. *M., P.*

(*Upeneus tetraspilus* Gthr.)

Panama (*Dow; Gthr.; Steind.*).

242. Upeneus dentatus* Gill.

Cape San Lucas (*Xantus*).

Family 42.—SCIÆNIDÆ.

109. SCIÆNA Linnæus.

243. Sciæna oscitans* Jordan & Gilbert. *P.*

244. Sciæna,* sp. indescr. *P.*

245. Sciæna ericymba* Jordan & Gilbert *P.*

246. Sciæna fürthi* Steindachner. *P.*

Panama (*Steind.*).

247. Sciæna typica* Gill. *P.*

(*Corvina ophioscion* Gthr.; *Ophioscion typicus* Gill.)

Panama (*Gill*).

248. Sciæna imiceps* Jordan & Gilbert. *P.*

249. Sciæna chrysoleuca* Günther. *P.*

(? *Sciæna aluta* Jordan & Gilbert.)

Panama (*Gthr.*); La Union (*Nichols*).

250. Sciæna sciera* Jordan & Gilbert. *M., P.*

Punta Arenas (Gilb.).

251. Sciæna vermicularis* Günther. *P.*

Panama (*Gthr.*).

252. **Sciæna armata** * † Gill. *P.*
(*Corvina acutirostris* Steind.)
Panama (*Gill; Steind.*); Punta Arenas (*Gilb.*).

253. **Sciæna icistia** * Jordan & Gilbert. *M.*

254. **Sciæna ensifera** * Jordan & Gilbert. *P.*
(*Corvina fulgens* Vaillant & Bocourt.)
Punta Arenas (*Gilb.*); La Union (*Boc.*).

255. **Sciæna,** * sp. indescr.

256. **Sciæna macrops** * Steindachner. *P.*
Panama (*Steind.*).

110. ODONTOSCION Gill.

257. **Odontoscion archidium** * Jordan & Gilbert. *P.*

111. LARIMUS Cuvier.

258. **Larimus breviceps** * † Cuvier & Valenciennes. *M.*, *P.*
Punta Arenas (*Gilb.*); Panama (*Gthr.*); West Indies.

259. **Larimus argenteus** * Gill. *P.*
Panama (*Dow*).

112. EQUES Bloch.

260. **Eques**, sp. indescr * *P.*

113. POLYCIRRHUS Bocourt.

261. **Polycirrhus dumerili** * Bocourt. *P.*
(*Genyonemus fasciatus* Steind.)
Panama (*Steind.*); La Union (*Boc.*).

114. MICROPOGON Cuv. & Val.

262. **Micropogon altipinnis** * Günther. *P.*
Panama, Chiapam, San José (*Gthr.*).

263. **Micropogon ectenes** * Jordan & Gilbert. *M.*

115. UMBRINA Cuvier.

264. **Umbrina xanti** * Gill. *M.*, *P.*
(*Umbrina analis* Gthr.)
Cape San Lucas (*Xantus*); Punta Arenas (*Gilb.*); Panama (*Gthr.*).

265. **Umbrina dorsalis** * Gill. *M.*
Cape San Lucas (*Xantus*).

116. MENTICIRRUS Gill.

266. **Menticirrus nasus** * Günther. *M.*, *P.*
Panama (*Gthr.*).

267. **Menticirrus panamensis** * Steindachner. *M.*, *P.*
Panama (*Steind.*).

268. **Menticirrus elongatus** * Günther. *M.*
Chiapam (*Gthr.*).

117. PARALONCHURUS Bocourt.

269. Paralonchurus petersi * Bocourt. *P.*

270. Paralonchurus, sp. indescr. *P.*

118. NEBRIS Cuvier.

271. Nebris microps * † Cuv. & Val. *P.*

Panama (*Steind.*); West Indies.

119. CYNOSCION Gill.

272. Cynoscion reticulatum * Günther. *M., P.*

Acapulco (*Nichols*); San José, Chiapam, Panama (*Gthr.*).

273. Cynoscion xanthulum * Jordan & Gilbert. *M.*

274. Cynoscion album * Günther. *P.*

Chiapam (*Gthr.*); Panama (*Gthr.; Steind.*).

275. Cynoscion stolzmanni * Steindachner. *P.*

Tumbez (*Steind.*).

276. Cynoscion parvipinne * Ayres.
(*Otolithus magdalenæ* Steind.)

Gulf of California (*Nichols*); Magdalena Bay (*Steind.*); California.

277. Cynoscion, * sp. indescr. *P.*

278. Cynoscion phoxocephalum * Jordan & Gilbert.

279. Cynoscion othonopterum * Jordan & Gilbert. *P.*

Guaymas (*Nichols*); Gulf of California (*Streets*).

280. Cynoscion squamipinne * Günther.

La Union (*Nichols*); Panama (*Gthr.; Steind.*).

120. ANCYLODON Cuvier.

281. Ancylodon jaculidens * † Cuv. & Val. *P.*

Brazil.

121. ISOPISTHUS Gill.

282. Isopisthus remifer * Jordan & Gilbert. *P.*

Family 43.—GERRIDÆ.

122. GERRES Cuvier.

283. Gerres gracilis * Gill. *M., P.*

Guaymas (*Nichols*); Cape San Lucas (*Xantus*); West Indies.

284. Gerres dowi * Gill. *P.*

Panama (*Dow*); Panama, Callao, and Galapagos Islands (*Steind.*).

285. Gerres californiensis * Gill. *M.*

Guaymas (*Nichols*); Cape San Lucas (*Xantus*).

286. Gerres cinereus * † Walbaum. *M.*, *P.*

Chiapam, Panama (*Gthr.*), West Indies.

287. Gerres aureolus * Jordan & Gilbert. *P.*

288. Gerres peruvianus * Cuvier & Valenciennes. *M.*, *P.*

Punta Arenas (*Gilb.*); Payta (*C. & V.*); Chiapam (*Gthr.*); Salina Cruz (*Nichols*).

289. Gerres lineatus * Humboldt. *M.*

(*Gerres axillaris* Gthr.)

Acapulco (*Humboldt; Bradley*); San Blas (*Nichols*); Chiapam (*Gthr.*).

290. Gerres brevimanus * Günther.

Chiapam (*Gthr.*).

Family 44.—LABRIDÆ.

123. BODIANUS Bloch.

291. Bodianus diplotænia * Gill.

Cape San Lucas (*Xantus*).

292. Bodianus pectoralis * Gill.

Cape San Lucas (*Xantus*); Panama (*Dow*) (male of the preceding ?).

124. PLATYGLOSSUS Bleeker.

293. Platyglossus dispilus * Günther. *M.*

Panama (*Gthr.*); Acapulco (*Steind.*).

294. Platyglossus nicholsi * Jordan & Gilbert.

Socorro Island (*Nichols*).

125. PSEUDOJULIS Bleeker.

295. Pseudojulis notospilus * Günther. *M.*, *P.*

Panama (*Gthr.*).

126. THALASSOMA Swainson.

296. Thalassoma lucasanum * Gill. *M.*

Cape San Lucas (*Xantus*).

297. Thalassoma melanochir Bleeker. ?

Acapulco (*Steind.*); (Sandwich Islands).

127. XYRICHTHYS Cuvier.

298. Xyrichthys mundiceps * Gill.

Cape San Lucas (*Xantus*).

299. Xyrichthys mundicorpus * Gill.

Cape San Lucas (*Xantus*).

128. SCARUS Forskål.

300. Scarus perrico * Jordan & Gilbert. *M.*, *P.*

301. Scarus, * sp. indescr. *P.*

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Family 45.—POMACENTRIDÆ.

129. POMACENTRUS Lacépède.

302. Pomacentrus rectifrænum Gill. *M., P.*
Cape San Lucas (*Xantus*).

303. Pomacentrus flavilatus * Gill. *M.*
Cape San Lucas (*Xantus*).

304. Pomacentrus quadrigutta * Gill.
Cape San Lucas (*Xantus*).

130. GLYPHIDODON Lacépède.

305. Glyphidodon saxatilis † troscheli * Gill. *M., P.*
Cape San Lucas (*Xantus.*)

306. Glyphidodon declivifrons * † Gill. *M.*
(*Euschistodus concolor* Gill.)
San Salvador (*Dow*); West Indies.

131. CHROMIS Cuvier.

307. Chromis atrolobatus * Gill. *P.*
Cape San Lucas (*Xantus*).

Family 46.—EPHIPPIDÆ.

132. PARAPSETTUS Steindachner.

308. Parapsettus panamensis * Steindachner. *P.*
Panama (*Steind.*).

133. CHÆTODIPTERUS Lacépède.

309. Chætodipterus faber † zonatus * Girard. *M., P.*
San Diego (*Grd.*).

Family 47.—CHÆTODONTIDÆ.

134. CHÆTODON Linnæus.

310. Chætodon humeralis * Günther. *M.*?, *P.*
Colima (*Xantus*); Panama (*Gthr.*).

311. Chætodon nigrirostris * Gill.
Cape San Lucas (*Xantus*).

135. HOLACANTHUS Lacépède.

312. Holacanthus strigatus * Gill.
Cape San Lucas, Colima (*Xantus*).

136. POMACANTHUS Lacépède.

313. Pomacanthus zonipectus* Gill.
(*Pomacanthus crescentalis* Jordan & Gilbert.) *M.*, *P.*

San Salvador (*Dow*).

Family 48.—ACANTHURIDÆ.

137. TEUTHIS Linnæus.

314. Teuthis tractus* Poey. *M.*, *P.*

(West Indies.)

138. PRIONURUS Lacépède.

315. Prionurus punctatus* Gill.

Cape San Lucas (*Xantus*).

Family 49.—MALACANTHIDÆ.

139 CAULOLATILUS Gill.

316. Caulolatilus princeps* Jenyns.
(*Caulolatilus affinis* Gill.)

Cape San Lucas (*Xantus*); Galapagos Islands (*Jenyns*); California.

Family 50.—GOBIIDÆ.

140. GOBIOMORUS Lacépède.

317. Gobiomorus lateralis* Gill.

Panama (*Dow*); Colima (*Xantus*); Cape San Lucas (*Xantus, Belding*).

141. DORMITATOR Gill.

318. Dormitator latifrons* Richardson. *M.*
(*Dormitator microphthalmus* Gill.)

Salina Cruz (*Nichols*); Cape San Lucas (*Xantus*); Colima (*Xantus*); Panama (*Dow*).

142. ELEOTRIS Bloch & Schneider.

319. Eleotris pisonis Gmelin.
(*Eleotris picta* Kner & Steind.)

Rio Bayano (*Kner & Steind.*).

320. Eleotris æquidens* Jordan & Gilbert. *M.*

Colima (*Xantus*); Cape San Lucas (*Belding*).

143. GYMNELEOTRIS Bleeker.

321. Gymneleotris seminuda Günther.

Panama (*Gthr.*).

144. GOBIUS Linnæus.

322. **Gobius banana** * Cuv. & Val.
Cape San Lucas (*Belding*).

323. **Gobius soporator** * † Cuv. & Val. *M. P.*
Everywhere. (West Indies.)

324. **Gobius sagittula** * Günther. *M. P.*
Panama (*Gthr.*).

325. **Gobius paradoxus** * Günther. *P.*
Panama (*Gthr.*).

326. **Gobius seminudus** * Günther. *P.*
Panama (*Gthr.*).

327. **Gobius emblematicus** * Jordan & Gilbert. *P.*

145. GOBIOSOMA Girard.

328. **Gobiosoma histrio** * Jordan.
Guaymas (*Emeric*).

329. **Gobiosoma zosterurum** * Jordan & Gilbert. *M.*

330. **Gobiosoma longipinne** Steindachner.
Las Animas Island, Gulf of California (*Steind.*).

146. TYNTLASTES Günther.

331. **Tyntlastes brevis** Günther.
Panama (*Gthr.*).

332. **Tyntlastes sagittta** Günther.
California (*Gthr.*).

Family 51.—SCORPÆNIDÆ.

147. SEBASTOPSIS Gill.

333. **Sebastopsis xyris** * Jordan & Gilbert.
Cape San Lucas (*Xantus*).

148. SCORPÆNA Linnæus.

534. **Scorpæna plumieri** * † Bloch. *M., P.*
Common.

Family 52.—TRIGLIDÆ.

149. PRIONOTUS Lacépède.

335. **Prionotus birostratus** * Richardson. *P.*
Gulf of Fonseca (*Rich.*).

336. **Prionotus horrens** Richardson.
Gulf of Fonseca (*Rich.*).

Family 53.—GOBIESOCIDÆ.

150. GOBIESOX Lacépède.

337. **Gobiesox rhessodon** Rosa Smith.
Gulf of California (*Lock.*); San Diego.

338. **Gobiesox adustus** * Jordan & Gilbert. *M.*

339. **Gobiesox zebra** * Jordan & Gilbert. *M.*

340. **Gobiesox rhodospilus** Günther.
Panama (*Gthr.*).

341. **Gobiesox erythrops** * Jordan & Gilbert. *M.*
Tres Marias Islands (*Gilbert*).

343. **Gobiesox eos** * Jordan & Gilbert. *M.*

Family 54.—BATRACHIDÆ.

151. BATRACHOIDES Lacépède.

3 **c hoides pacifici** * Günther. *P.*
Panama (*Gthr.*).

345. **Batrachoides surinamensis** † Bloch.
Panama (*Gthr.*) (West Indies).

152. PORICHTHYS Girard.

346. **Porichthys margaritatus** * Richardson. *P.*
Common. (Apparently in deep water southward; a shore fish northward.)

153. THALASSOPHRYNE Günther.

347. **Thalassophryne reticulata** * Günther.
Panama. (*Günther*, *Bradley*).

348. **Thalassophryne**, sp. indescr. *P.*

Family 55.—LEPTOSCOPIDÆ.

154. DACTYLOSOPUS Gill.

349. **Dactyloscopus mundus** * Gill.
Cape San Lucas (*Xantus*); Panama (*Bradley*).

350. **Dactyloscopus pectoralis** * Gill.
Cape San Lucas (*Xantus*).

155. MYXODAGNUS Gill.

351. **Myxodagnus opercularis** * Gill.
Cape San Lucas (*Xantus*).

Family 56.—OPISTHOGNATHIDÆ.

156. GNATHYPOPS Gill.

352. Gnathypops rhomaleus * Jordan & Gilbert.

Gulf of California (*Nichols*).

157. OPISTHOGNATHUS Cuvier.

353. Opistognathus punctata * Peters. *P.*

Mazatlan (*Peters*).

Family 57.—BLENNIIDÆ.

158. OPHIOBLENNIUS Gill.

354. Ophioblennius webbi * Valenciennes.

Navidad (*Steind.*); Tres Marias Islands (*Steind.*); (Canary Islands).

159. HYPSOBLENNIUS Gill.

355. Hypsoblennius brevipinnis * Günther. *M.*

Panama (*Gthr.*).

356. Hypsoblennius gentilis * Girard.

Cape San Lucas (*Xantus*) (California).

357. Hypsoblennius striatus * Steindachner. *P.*

Panama (*Steind.*).

160. SALARIAS Cuvier.

358. Salarias rubropunctatus * Cuv. & Val.

Panama, Callao (*Bradley*); Peru (*C. & V.*).

161. RUPISCARTES Swainson.

359. Rupiscartes chiostictus * † Jordan & Gilbert. *M.*

360. Rupiscartes atlanticus * † Cuv. & Val. *M.*

San Cristobal Bay (*Townsend*); Cape San Lucas (*Xantus*); West Indies.

162. EMBLEMARIA Jordan & Gilbert.

361. Emblemaria nivipes * † Jordan & Gilbert.

Pearl Island (*Bradley*); Pensacola (*Stearns*).

163. LABROSOMUS.

362. Labrosomus nuchipinnis † xanti * Gill. *M.*

Cape San Lucas (*Xantus*); San Cristobal Bay (*Townsend*).

363. Labrosomus zonifer * Jordan & Gilbert. *M.*

364. Labrosomus macrocephalus * Günther.

Panama (*Gthr.*, *Bradley*).

164. **TRIPTERYGION** Risso.

365. **Tripterygion carminale** * Jordan & Gilbert. *M.*

165. **CREMNOBATES** Günther.

366. **Cremnobates monophthalmus** * Günther. *P.*

367. **Cremnobates integripinnis** * Rosa Smith. *M.*
San Cristobal Bay (*Townsend*); California.

368. **Cremnobates altivelis** Lockington.
Gulf of California (*Lock.*).

166. **APODICHTHYS** Girard.

369. **Apodichthys univittatus** Lockington.
Gulf of California (*Lock.*).

167. **PHOLIDICHTHYS** Bleeker.

370. **Pholidichthys anguilliformis** * Lockington.
Amortignado Bay; Gulf of California (*Lock.*).

Family 58.—CERDALIDÆ.

168. **CERDALE** Jordan & Gilbert.

371. **Cerdale ionthas** * Jordan & Gilbert. *P.*

169. **MICRODESMUS** Günther.

372. **Microdesmus dipus** Günther.
Panama (*Gthr.*); Gulf of California (*Lock.*).

373. **Microdesmus retropinnis** * Jordan & Gilbert. *P.*

Family 59.—FIERASFERIDÆ.

170. **FIERASFER** Cuvier.

374. **Fierasfer dubius** * Putnam.
(*Fierasfer arenicola* Jordan & Gilbert.) *M.*
Pearl Islands (*Bradley & Putnam*).

Family 60.—BROTULIDÆ.

171. **DINEMATICHTHYS** Bleeker.

375. **Dinematichthys ventralis** * Gill. *M.*
Cape San Lucas (*Xantus*).

Family 61.—PLEURONECTIDÆ.

172. PLATOPHRYS Swainson.

376. Platophrys leopardinus * Günther.

Guaymas (*Emeric*).

173. CITHARICHTHYS Bleeker.

377. Citharichthys latifrons * Jordan & Gilbert. *P.*

378. Citharichthys ovalis * Günther. *M., P.*

Panama (*Gthr.*).

379. Citharichthys panamensis * Steindachner. *P.*

Panama (*Steind.*).

380. Citharichthys,* sp. indescr. *M., P.*

381. Citharichthys spilopterus * † Günther. *M., P.*

(West Indies.)

174. ETROPUS Jordan & Gilbert.

382. Etropus crossotus Jordan & Gilbert. *M., P.*

(Gulf of Mexico.)

175. PARALICHTHYS Girard.

383. Paralichthys adspersus, * Steindachner. *M., P.*

Peru (*Steind.*).

176. HIPPOGLOSSINA Steindachner.

384. Hippoglossina macrops Steindachner.

Mazatlan (*Steind.*).

177. ANCYLOPSETTA Gill.

385. Ancylopsetta, * sp. indescr. *P.*

Family 62.—SOLEIDÆ.

178. ACHIRUS Lacépède.

386. Achirus mazatlanus * Steindachner. *M.*

(*Solea pilosa* Peters.)

Mazatlan (*Steind.; Peters*).

387. Achirus klunzingeri * Steindachner. P.

Peru (*Steind.*).

388. Achirus scutum Günther.

Panama, Gulf of Fonseca (*Gthr.*).

389. Achirus fimbriatus Günther.

Gulf of Fonseca (*Gthr.*).

390. Achirus fonsecensis Günther.

Gulf of Fonseca (*Gthr.*).

179. APHORISTIA Kaup.

391. **Aphoristia elongata*** Günther.

Panama (*Gthr.*).

392. **Aphoristia atricauda*** Jordan & Gilbert.

Cape San Lucas (*Belding*).

Family 63.—ANTENNARIIDÆ.

180. ANTENNARIUS Lacépède.

393. **Antennarius sanguineus*** Gill.
(*Antennarius leopardinus* Gthr.)

Panama (*Gthr.; Bradley*); Cape San Lucas (*Xantus*).

394. **Antennarius strigatus*** Gill.
(*Antennarius tenuifilis* Gthr.)

Panama (*Gthr.; Bradley*); Cape San Lucas (*Xantus*).

Family 64.—MALTHIDÆ.

181. MALTHE Cuvier.

395. **Malthe elater*** Jordan & Gilbert. *M.*

Family 65.—BALISTIDÆ.

182. BALISTES Linnæus.

396. **Balistes polylepis*** Steindachner. *M., P.*

Magdalena Bay, Mazatlan, Acapulco (*Steind.*).

397. **Balistes capistratus*** Shaw. *M.*
(*Balistes mitis* Bennett.)

Acapulco (*Steind.*).

398. [1] **Balistes mento*** Jordan & Gilbert.

Clarion Island.

Family 66.—TETRODONTIDÆ.

183. TETRODON.

399. **Tetrodon politus*** Ayres. *M.*

(San Diego.)

400. **Tetrodon testudineus*** † L. *P.*
(*Tetrodon annulatus* Jenyns; *Tetrodon heraldi* Günther.)

Panama and southward (*Gthr.*) (West Indies).

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[1] In the original description this species is erroneously said to have but two dorsal spines. The third spine, which is very small, was overlooked by us.

401. Tetrodon fürthi * Steindachner. *P.*

Panama (*Steind.*).

402. Tetrodon angusticeps * Jenyns.

(*Canthogaster lobatus* Steind.)

Panama (*Bradley*); Altata (*Steind.*); Galapagos (*Jenyns*).

184. AROTHRON Müller.

(*Ovum* Bloch & Schneider; preoccupied.)

403. Arothron erethizon* Jordan & Gilbert. *P.*

Panama (*Bradley*).

185. PSILONOTUS Swainson.

404. Psilonotus punctatissimus * Günther.

(*Tetrodon oxyrhynchus* Lockington.)

Cape San Lucas (*Xantus*); Panama (*Gthr.*); Gulf of California (*Lockington*).

Family 67.—DIODONTIDÆ.

186. DIODON Linnæus.

405. Diodon hystrix * † Linnæus. *M.*

(West Indies, &c.)

406. Diodon liturosus * † Shaw.

Lower California.

Family 68.—ORTHAGORISCIDÆ.

187. MOLA Cuvier.

407. Mola mola * † Linnæus. *M.*

Common.

OBSERVATIONS.

According to the above list it appears that of 407 species of fishes, now known from the Pacific coasts of Mexico and Central America, 71 species or 17½ per cent. are found also on the Atlantic coasts. If we add to this some 800 species, now known from the Caribbean Sea and adjacent shores, we have about 6 per cent. of the whole number known, as common to the two coasts. This number, 71, is not very definitely ascertained, as there must be considerable difference of opinion as to the boundaries of species, and as several of these species regarded as common are open to doubt and need verification. I believe, however, that fuller investigations will not increase the proportion of common species, and, if it does not, the two faunæ show no greater resemblances than the similarity of physical conditions on the two sides would lead us to expect.

This conclusion is opposed to those of Dr. Günther (Fishes of Central

America, 1869, 397). Dr. Günther assumes that nearly one-third of the total number of species of marine fishes on the two shores of tropical America will be found to be identical. Hence he infers that there must have been, at a comparatively recent date, a depression of the isthmus, producing an intermingling of the two faunæ.

This discrepancy arises from the comparatively limited representation of the two faunæ at the disposal of Dr. Günther. He enumerates 193 marine or brackish-water species, as found on the two coasts, 59 of which are regarded by him as specifically identical—this being 31 per cent. of the whole. But in 30 of these 59 cases I regard the assumption of complete identity as erroneous, so that taking the number 193, as given, I would reduce the percentage to 15. But these 193 species form but a fragment of the total fauna, and any conclusions based on such narrow data are certain to be misleading.

Of the 71 identical species admitted in our list, several (*e. g.*, *Mola*, *Orcynus*) are pelagic fishes common to most warm seas. Still others (*e. g.*, *Trachurus*, *Caranx*, *Diodon*, sp.) are almost cosmopolitan in the tropical waters. Most of the others (*e. g.*, *Gobius*, *Gerres*, *Centropomus*, *Galeichthys* sp., &c.) often ascend the rivers of the tropics, and we may account for their diffusion perhaps, as we account for the dispersion of fresh-water fishes on the isthmus, on the supposition that they may have crossed from marsh to marsh at some time in the rainy season.

In very few cases are representatives of any species from opposite sides of the isthmus exactly alike in all respects. These differences in some cases seem worthy of specific value, giving us "representative species," on the two sides. In other cases, the distinctions are very trivial, but in most cases, they are appreciable, especially on fresh specimens.

I am therefore brought to the conclusion that the fish faunæ of the two shores of Central America are substantially distinct, so far as species are concerned, and that the resemblance between them is not so great as to necessitate the hypothesis of the recent existence of a channel across the isthmus, permitting the fishes to pass from one side to the other.

INDIANA UNIVERSITY, *July* 18, 1885.

NOTE ON SOME LINNÆAN NAMES OF AMERICAN FISHES.

By DAVID S. JORDAN.

In the current volume of these Proceedings (pp. 193–208) is a very useful "contribution to the stability of American ichthyological nomenclature," entitled "On the American Fishes in the Linnæan Collection," by Messrs. Goode and Bean.

Most of the changes suggested in this paper are well founded, and some of them have already been adopted by the writer from verbal statements of Dr. Bean. A few seem to need further discussion.

1. Zeus gallus L.

This species seems properly referable to the American species of *Selene*, although the reference to Willoughby belongs to an East Indian fish. The name *Selene gallus* should be adopted for our species, if it can be shown that it is not the *Zeus vomer*, with which it has been universally identified.

2. Zeus vomer L.

Goode and Bean say that this "is the species which has long figured in American writings as *Vomer setipinnis*, which must now be called *Vomer vomer*."

The grounds for this statement are not apparent. The *Zeus vomer* of the tenth edition is based on the *Rhomboida* of Brown, which is the *setipinnis*, and on the *Zeus cauda bifurca* of the Museum of Adolph-Frederick.

In the twelfth edition the reference to Brown disappears, while a few additional characters are added to the description, which still contains nothing positively distinctive.

I have at present no copy of the Museum Adolph-Frederick at hand, but it seems to me that the name *Zeus vomer* must go with the fish there represented. Cuvier says: "L'espèce de ce poisson n'est sujette à aucun doute, puisque Linnæus lui-même en a donné la figure dans le Musée d'Adolphe-Fréderic, pl. 31, f. 9;" and again, "Celle [la figure] de Linnæus (Mus. Ad. Fred., pl. 31, fig. 9) pèche par la rupture des filets de la première dorsale."

If this *Zeus vomer* of Linnæus is the species with falcate dorsal, as Cuvier has supposed, the name *vomer* is prior to that of *gallus*, and the two species in question should stand, as hitherto, *Selene vomer* and *Vomer setipinnis*. If the supposition of Goode and Bean be correct, they would be *Selene gallus* and *Vomer vomer*. The question seems to depend on the correct interpretation of the figure in the Museum Adolph-Frederick.

Pleuronectes plagiusa L.

The account given by Goode and Bean renders it doubtful whether our *Aphoristia* is really identical with the Linnæan type. Our species should in this case apparently stand as *A. fasciata* (= *Plagusia fasciata* Holbrook MSS., Dekay N. Y. Fauna Fishes, p. 304). The West Indian *Aphoristia ornata* seems to be distinct from the species found on our coasts, having the vertical fins black posteriorly, the body rather slenderer than in ours, the scales a little larger, and the fin rays rather fewer. It may be that this *ornata* is the original *plagiusa*.

Pleuronectes lunatus L.

This species was originally based solely on a figure of Catesby, representing *Platophrys lunatus*. In the twelfth edition the count of the fin-rays is added from the specimen sent by Garden, belonging to a different species.

Labrus hiatula L.

In suggesting the name *Hiatula hiatula*, for the tautog, Goode and Bean seem to forget that the *Labrus onitis* of the tenth edition, commonly and apparently correctly identified with the tautog, has priority over *Labrus hiatula* of the twelfth edition.

Perca rhomboidalis L.

In the tenth edition this name is based on the Pork-fish of Catesby, which is *Anisotremus virginicus* L. and on a *Sparus* of Brown (= *Diplodus unimaculatus*). The name *rhomboidalis* is borrowed from Catesby, and it is with Catesby's figure, I think, that the name *rhomboidalis* must go. In this view it becomes a synonym of the earlier *Sparus virginicus* L.

This species, "*Perca rhomboidalis*," gives place in the twelfth edition to a *Sparus rhomboides*, having the same synonymic references, but with a different description, taken from the specimen of *Diplodus rhomboides* sent by Dr. Garden. This specimen is properly the type of *rhomboides*, but not of *rhomboidalis*, and I see no reason why the former name should give way to the latter.

Perca guttata L.

This species was originally based on a number of references belonging to different species, with no indication either in the tenth or the twelfth edition that Linnæus possessed any specimen at all. One of these references certainly belongs to the species represented by the specimen examined by Goode and Bean, and possibly we are justified in accepting this specimen as the real Linnæan type; if so, the name *Epinephelus guttatus* may be used instead of that of *Epinephelus apua* (= *lunulatus* Poey).

Trigla evolans L.

This species is apparently identical with the *Prionotus sarritor* of Jordan and Gilbert.

Hæmulon arcuatum Cuv. & Val.

The specific name *plumieri*, which the writer and others have ineffectually attempted "to saddle on this fish" ever "since the time of Lacépède" (cf. Goode & Bean, p. 207), is based upon Lacépède's bad engraving of Aubriet's bad copy of a painting labeled "*Turdus aureo-cœruleus*," by Plumier. Lacépède's figure is certainly of little value; but Cuvier, who apparently had access to the original figure of Plumier, declares that "le père Plumier l'avait dessiné bien avant Catesby et Duhamel."

Of course, if this is the species which Plumier meant to represent, it should be called *Hœmulon plumieri*; if not, then *Hœmulon arcuatum* is its proper designation.

The badness of Lacépède's engraving, if Plumier's intention be admitted, has nothing to do with the question.

This species is certainly *not* the Margate-fish of Catesby, which is *Hœmulon gibbosum* (*album*).

INDIANA UNIVERSITY, *July* 26, 1885.

ON A COLLECTION OF MEDUSÆ MADE BY THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS IN THE CARIBBEAN SEA AND GULF OF MEXICO.

By J. WALTER FEWKES.

The greater part of this collection was made in the years 1884 and 1885. It contains no descriptions of new species, but is interesting in a study of the geographical distribution of these animals and is a supplement to a paper already prepared on the Medusæ of the Gulf Stream. Many of the genera and species here mentioned up to the present have not been recorded from the region of the Gulf Stream, but will probably be later taken from this locality.

Family TAMOYIDÆ.

TAMOYA, sp.

Specimen examined.

Catalogue number.	Station.	Locality.	
		North latitude.	West longitude.
10730	....	About 22°	About 84°

Family PELAGIDÆ.

PELAGIA CYANELLA, Peron et Lesueur.

Specimen examined.

Catalogue number.	Station.	Locality.	
		North latitude.	West longitude.
		° ′ ″	° ′ ″
7545	Hyd. 123	15 49 00	67 36 40

Family LINERGIDÆ.

LINERGES MERCURIUS, Hæckel.

Specimens examined.

Catalogue numbers.	Station.	Locality.	
		North latitude.	West longitude.
		° ′ ″	° ′ ″
7560	Hyd. 415	21 46 00	84 58 20
7564	Hyd. 411	19 55 00	84 19 45
7565	Hyd. 410	19 11 00	84 01 15
8744	....	Off Havana.	

Family STOMOLOPHIDÆ.

STOMOLOPHUS MELEAGRIS, Agassiz.

Specimen examined.

Catalogue number.	Station.	Locality.	
		North latitude.	West longitude.
		° ′ ″	° ′ ″
7543	Hyd. 97	11 12 20	62 11 10

Family CASSIOPEIDÆ.

CASSIOPEA FRONDOSA, Lamarck.

Specimen examined.

Catalogue number.	Station.	Locality.
7467	....	Curaçoa.

The teratology of the medusan group from many considerations is a large field for research. We have all kinds of variations in organs, their arrangement, number, bifurcations, modes of development, and the like. The genus *Cassiopea* seems particularly subject to such abnormalities as its mode of life and anatomy might suggest. I have already described in *Cassiopea* (*Bull. Mus. Comp. Zool.*, vol. ix, No. 7) variations in the number of marginal sense bodies, and the existence of two ocelli on one "sense club," and two otocysts on the same peduncle. The abnormal condition described below is one which I have never before met with. The irregularity consists in the addition of a new oral arm on the under oral side of the subumbrella, homologous with one of the branching organs from the oral cylinder, although not arising from that body.

The oral cylinder appears to be normal on the under side of the umbrella, about one-half the distance from the edge of the base of the same to the bell margin, in the same radius as one of the normal oral arms adjoining that in which a sexual opening lies, there is an additional rudimental oral arm. This structure resembles the distal extremity of a normal arm and arises by a gelatinous base from the under surface of the bell walls. It is gelatinous, bifid, with sucker-frills along its free edge as in normal rhizostomatous genera.

The line of junction with the lower surface of the umbrella is at right angles to the radius in which it lies. It is separated from the oral cylinder by an unmodified, normal, region of the umbrella.

I have not dissected its attachments and therefore am unable to speak of modifications of chymiferous tubes, if such occur in the immediate

vicinity of its attachment. The question suggests itself whether this abnormal position of the oral arm implies a beginning of a fission or a wound in the body of the *Cassiopea*. There is nothing to throw any light on either of these explanations or to definitely answer either question.

Family VELELLIDÆ.

VELELLA MUTICA, Bosc.

Specimens examined.

Catalogue numbers.	Stations.	Locality. North latitude.			Locality. West longitude.		
		°	′	″	°	′	″
7557	Hyd. 360	9	51	15	79	20	30
7606	Hyd. 372	11	43	30	80	51	30
10724	Hyd. 2352	22	35	00	84	23	00
10718	Hyd. 2380	28	02	30	87	43	45
10719	Hyd. 2380	28	02	30	87	43	45
10723	Hyd. 2384	28	45	00	88	15	30
10725	Hyd. 2393	28	43	00	87	14	30
10721	Hyd. 2400	28	41	00	86	07	00
7558	Hyd. 2142	9	30	15	76	20	30
7559	....	Caribbean Sea.					
10729	....	About 20°			About 86°		
8745	....	Unknown.					

RATARIA, sp. (Young *Velella* or *Porpita*).

Specimens examined.

Catalogue numbers.	Stations.	Locality. North latitude.			Locality. West longitude.		
		°	′	″	°	′	″
7543	Hyd. 97	11	12	20	62	11	10
7563	Hyd. 138	10	51	30	67	01	40
10726	2379	28	00	15	87	42	00
10718	2380	28	02	30	87	43	45
10719	2380	28	02	30	87	43	45

Family ABYLIDÆ.

ABYLA TRIGONA, Quoy and Gaimard.

(Plate XX.)

*Specimens examined.**

Catalogue number.	Station.	Locality. North latitude.			Locality. West longitude.		
		°	′	″	°	′	″
10724	2352	22	35	00	84	23	00

* This description is made from a specimen taken outside the areas treated of in the present report. The posterior nectocalyx only is found in the specimen from Station 2352.

The examples described came from the following locality. That from the Station 2352 is the same as far as the organs are present:

Catalogue number.	Locality.	
	Latitude.	East longitude.
8764	Equator.	° ′ ″ 90 00 00

ANTERIOR NECTOCALYX.

(Figs. 1, 2, and 3.)

The anterior nectocalyx measures 10^{mm} in length and 10^{mm} in breadth. When seen from the side the thickness is 7^{mm}.

Two faces may be distinguished, an anterior (Fig. 1), and a posterior (Fig. 2). The cavity of the nectocalyx (*cav.*) lies under or deeper than the anterior face; the somatocyst (*sm.*) under the posterior face. Externally these two faces may be distinguished as follows: The anterior face (*a.*) has a rectangular shape, and from it the antero-lateral faces (*al.*) slope off on either side, while on the lower sloping face an entrance (*cav.*) into the bell cavity (*cav.*) Fig. 3 can be seen. The central portion of the walls of the posterior face (Fig. 2) rises in a prominent cubical or spherical body (*p.*), 6^{mm} in length by 5^{mm} in breadth, in the center of which lies the cavity of the somatocyst (*sm.*).

Between the lower edge of this projection and the lower rim of the nectocalyx there is a triangular opening (*y.*) into which fits the anterior projection of the distal nectocalyx.

The anterior face (*a.*), (*au.*), (*al.*) is made up of five planes. A rectangular anterior plane (*a.*) bounded by four ridges, extending about 7^{mm} in length and 2^{mm} in breadth, occupies the medial portion of the face. On the upper side it forms one side of a hexagonal surface which occupies this end of the anterior nectocalyx (*au.*). The hexagonal plane may be called the upper plane of the anterior nectocalyx. Of the five remaining sides of the hexagon two adjacent sides are the upper bounding lines of the antero-lateral surfaces (*al.*), two others are the posterior lateral surfaces (*pl.*), and the side of the hexagon opposite the upper bounding line of the anterior rectangle, in the upper bounding line of the anterior face of the nectocalyx.

On each side of the border of the anterior rectangle is likewise the bounding angle of an anterior lateral face or plane (*al.*). Of these there are two. The inner edge is the side of the rectangle (*a.*); the upper edge, the margin of one side of the upper hexagon. The outer edge is the lateral rim of the anterior face, which is convex, and likewise a lower side which forms a margin of the opening into the bell cavity.

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The margin of this surface (antero-lateral) is therefore made up of bounding lines of unequal length. As the outlines of the curved lines which form the sides opposite those of the anterior rectangle are somewhat distorted, it is not possible to determine whether they are simply curved or double, composed of two ridges forming at their junction an obtuse angle. The latter condition exists in *A. trigona* as described by Huxley.

Seen from the posterior face (Fig. 2) the anterior nectocalyx has a cubical or spherical projection in the middle, which is bounded by a triangular plane surface, the sides being at first almost parallel and then bending together below in a short angle just above the entrance into a depression (*y.*), into which fits the anterior extremity of the posterior nectocalyx. In the specimens preserved in alcohol the posterior lateral planes (*pl.*) are composed of two parts, one of which is parallel with the triangular plane, the other at right angles to it. The upper posterior plane (*up.*) is hexagonal, one side formed of the upper side of the posterior triangle. The two adjacent sides are formed by the bounding lines of the postero-lateral planes just mentioned and a part of the antero-lateral planes with the upper bounding line of the posterior face.

The posterior lateral planes (*p l.*) are polygonal with bounding lines of unequal length. The outer wall of these planes is the margin of the anterior nectocalyx, and the lower the ridge which forms a division between the lateral plane and the opening into the cavity, into which the anterior end of the posterior nectocalyx fits. The outer border of the lateral planes is toothed at the lower rim.

The great width of the antero-lateral (*al.*) and posterior lateral (*pl.*) planes imparts to the anterior nectocalyx a great breadth, and in alcohol we seem to have two lateral wings. How much of the shrinkage which causes this modification is due to the alcohol cannot now be determined. The thickness in the lateral walls between the middle line of the nectocalyx and the margin of the faces (anterior and posterior), or the crest of the bounding angle, is much greater than that which passes from the same line through either somatocyst or bell cavity. The same is also true in *A. trigona* described by Huxley.

In a bottle with the anterior nectocalyx are fragments which are identified as the posterior nectocalyces. These, however, are not fastened to the former, yet there is no doubt that they belong to the same genus.

POSTERIOR NECTOCALYX.

The posterior nectocalyx, although shrunken from its former pyramidal form, is in a good condition for study. Its whole length is 20^{mm}. The outer surface is crossed by three longitudinal crests, which extend

from the anterior extremity to the rim of the bell surrounding the opening into the bell cavity, where they are extended into projections more or less markedly serrated. In addition to these three longitudinal ridges there is on the posterior side of the largest a thin plate serrated at its lower edge, which forms as in *A. pentagona* a longitudinal sheath into which the axis can be withdrawn. When the bell is placed on one side, so that the anterior conical end of the bell is at the right hand side, the largest elevation will be seen above and the smaller below, while the serrated covering-plate lies between and parallel with the larger ridge. The margin of the larger ridge seen in this way is rounded and has two ridges, or is double for a short distance near the junction with the bell margin, or where it forms a projection. It gradually becomes reduced in elevation, passing from the posterior to the anterior extremity of the bell, and is more rounded posteriorly. The other elevations are slighter with indistinct serration on the crest. The covering-plate lies between the largest and the smallest. The section of the posterior nectocalyx which lies between them is the posterior face of the distal or posterior nectocalyx.

The internal organs are in too imperfect a condition for study. In the cavity of the somatocyst the remains of the "spongy" mass of cells were observed. The walls of the cavities of both anterior and posterior nectocalyces have become so shrunken that the course of the tubes could not be observed.

The stem and its appendages are broken off and are not found with the nectocalyces. This species resembles *A. trigona* Q. and G. more closely than it does the specimen described as *A. trigona* by Huxley. Minor differences from both do not warrant my redescribing it as a new species.

Family HIPPOPODIDÆ.

GLEBA HIPPOPUS, Forskål.

Specimens examined.

Catalogue number.	Station.	Locality.	
		North latitude.	West longitude.
10728	2395	28° 36′ 15″	86° 50′ 00″

This specimen is a single nectocalyx.

DESCRIPTION OF HESPEROMYS TRUEI, A NEW SPECIES BELONGING TO THE SUBFAMILY MURINÆ.

By **R. W. SHUFELDT**, *U. S. Army*.

Fort Wingate is a military station about 3 miles off the railroad in northwestern New Mexico. The country about it is hilly, with broad and more or less level valleys dividing the broken ranges. These hills support a growth of low piñons and a species of scrub-oak, while in many places their sides are covered with irregular groups of loose boulders of sandstone rock.

The highest point is something between 7,000 and 8,000 feet above the datum plane. The midsummer days may be very warm, and the thermometer has been known to fall as low as 15° Fahr. below zero in the winter months.

Among the smaller mammals to be found in this locality, the southwestern form of *Neotoma floridana* is probably the most abundant.

This handsome little rat often constructs its nest beneath one of the uptilted boulders, or sometimes in a fissure between two of them, and structures of this kind are frequently to be noticed in such situations as we ramble over the hill-sides, where the smaller masses of rocks are to be found. Occasionally it chooses for its home the shelter afforded by the gnarled roots of a piñon, where the elements have forced them above ground, or, more rarely, the hollow trunk of one of these trees, should it occur in a favorable situation.

Until the 16th of March, 1885, during my collecting excursions about Fort Wingate, I never experienced any difficulty in capturing, whenever I chose, a few specimens of this rat. All one had to do was to simply tear open one of their nests and pounce on its inhabitant with gloved hands. After the date mentioned, however, they suddenly disappeared, and on that very day I opened *seven* of these nests, apparently all new ones, only to find in each instance the owner missing.

On my way home from this unsuccessful hunt my attention was attracted to the outer covering of another nest protruding from an opening in the dead and hollow trunk of a small piñon, at least 2 feet above the ground. This was an uncommon site for the nest of a *Neotoma*, and taken in connection with the absence of the usual pile of rubbish about the entrance, and the small size of the trunk chosen, my curiosity was sufficiently aroused to determine me to investigate the occupant's stronghold.

The nest, composed of the fine fibers of the inner bark of the piñon, was soon pulled out, and its owner dislodged and captured alive and unhurt. It proved to be a mouse about half the size of the average *Neotoma*, colored very much like one, but possessing a pair of ears that

immediately impressed me on account of their being so disproportionately large for an animal of its dimensions.

For two days I kept this engaging little creature alive in my study for the purpose of making a drawing of its head and studies of its behavior and attitudes. It was then killed, carefully measured, skinned, and skeletonized.

A glance at its skull was sufficient to remove from my mind the last of any doubt I may have entertained as to its being a half-grown wood-rat. Indeed, its extraordinary ears had already fairly satisfied me of this fact, as they were fully as large, or even larger, than the average size of those appendages in the *Neotoma*. Besides, it was the wrong time of the year to come across a young animal of that species, to say nothing of the general appearance of maturity it evidenced both externally and in its skeleton.

Concluding, then, that it was some variety of *Hesperomys*, I forwarded the skin to my friend Mr. F. W. True, curator of the department of mammals in the United States National Museum. In his courteous and prompt reply he gave me to understand that he believed it to be "a typical *H. leucopus*, except so far as its ears are concerned." The diagnosis of course could not be conclusive, as he had not seen the skull of my specimen, and even the ears had somewhat shrunken in the skin, as they are sure to do.

Here the matter rested until the 16th of May, just two months after the capture of the specimen in question. On this date I was engaged in hunting for insects, not a thousand yards from the tree on the hill-side where my first specimen of *Hesperomys* was taken, but this time out in the broad valley that stretches between the latter point and the opposite range of hills. In turning over a heavy plank I surprised a family of field mice, but encumbered as I was with my collecting case and gun, I succeeded in capturing only the male and three half-grown young; the female and four more of the young ones making good their escape. The young proved to be about half the size of their parents, and of a deep slate color, forming a striking contrast with the light dun color of the latter.

Naturally, the first thing I examined in my new captive were his ears; these I found to be of like proportions with the same parts, as I remembered them, in eastern forms of field mice. These four specimens were consigned to alcohol for future comparisons with such other material as might come to hand.

Being convinced now that my first capture was a new species, I forthwith communicated with Mr. True to ascertain what could be done in regard to exact identification and description, as I was desirous of having the proper material before me for comparison.

Through this gentleman's kindness I was delighted to have at my command at the end of the following fortnight the subjoined list of additional specimens to compare with those already in my possession:

Specimens.	Locality.	Donor.	Catalogue number.	Remarks.
1. *H. leucopus*	Fort Simpson	B. R. Ross	4520	Skin.
1. *H leucopus*	Middleboro', Mass	J. W. P. Jenks	1434	Skin. Nat. Mus. type.
1. *H. leucopus*	Fort Cobb	Dr. Palmer	9251	Skin.
1. *H. leucopus*	California	Dr. Cooper	7183	Skin.
1. *H. leucopus*	Pennsylvania	Dr. E. Michener	4856	Skull.
1. *H. leucopus*	Missouri	Dr. F. V. Hayden	2235	Skull.

Fortunately on the 30th of the next month, and in the same valley where I had taken my male and three young, another capture was made, this time a female of the little harvest mouse, *Ochetodon humilis*, with three young barely an hour old. These latter were placed in alcohol, while the mother was carefully measured, skinned, and skeletonized.† The measurements will be found in the comparative tables below.

Along with the specimens from the National Museum, Mr. True also sent me Coues's measurements and identifications of the same. These former are in inches and fractions, and as I employ in making such measurements the metric system only, I have carefully reduced Coues's measurements in the table to that scale, in order to conveniently compare them with my own, as taken from three of my Fort Wingate captures, referred to in the foregoing paragraphs.

Table of measurements of six skins of Hesperomys, including the type of H. Truei; and of one skin of Ochetodon humilis.

[Taken in centimeters and fractions.]

Specimens.	Nose to—				Tail to—		Soles.		Depth of cheek-pouch.	Height of ear.	Remarks.
	Eye.	Ear.	Occiput.	Root of tail.	End of vertebræ.	End of hairs.					
4520. Hesperomys leucopus, ♀.*	1.5	2.6	3.8	7.7	7.3	7.6		1.9	1.7	1.3	....
1434. Hesperomys leucopus.*	1.3	2.5	3.0	8.9	8.1	8.4	....	....	......	1.3	Nat. Mus. type.
9251. H. l. sonoriensis.*	1.4	2.4	3.2	8.7	......	......	....	....	......	1.6	Skin stretched.
7183. H. leucopus.*	1.3	2.3	3.0	7.6	......	......	....	....	......	1.3	
							Manus.	Pes.			
14904. Hesperomys Truei, ♂.	1.3	2.4	3.5	8.7	8.2	9.2	1.0	2.0	......	2.5	Collected at Fort Wingate, N. Mex., 16 March, 1885, by Dr. R. W. Shufeldt, U. S. A.

* I have taken the liberty to add a few measurements to those taken by Coues, and correct others.

† It may be of interest to remark here that of the many specimens of the southwestern types of *Neotoma floridana* that I have taken and measured, the females have always proved to be notably larger than the males.—R. W. S.

Table of measurements of six skins of Hesperomys, &c.—Continued.

Specimens.	Nose to— Eye.	Nose to— Ear.	Nose to— Occiput.	Nose to— Root of tail.	Tail to— End of vertebræ.	Tail to— End of hairs.	Soles. Manus.	Soles. Pes.	Depth of cheek-pouch.	Height of ear.	Remarks.
Hesperomys leucopus, ♂.	1.4	2.4	3.1	7.8	7.2	7.5	1.1	2.0	......	1.7	Collected at Fort Wingate, N. Mex., 16 May, 1885, by Dr. R. W. Shufeldt, U. S. A.
15130. Ochetodon humilis, ♀.	1.1	2.1	2.4	7.1	6.1	6.3	0.9	1.6	......	1.3	Collected at Fort Wingate, N. Mex., 30 June, 1885, by Dr. R. W. Shufeldt, U. S. A. Nursing three young when captured.

Other interesting measurements are to be obtained from the two skulls of *Hesperomys leucopus* and that of *Ochetodon humilis* now before me, and for their convenient comparison these are also presented in a tabulated form.

Table of measurements of three skulls of Hesperomys, including the type of H. Truei, and of one skull of Ochetodon humilis.

[Given in centimeters and fractions.]

Catalogue number.	Species.	Sex.	Greatest length of skull.	Interzygomatic diameter (greatest width).	Depth of skull measured from vault of cranium to basisphenoid.	Remarks.
2235	Hesperomys sonoriensis	♂	2.55	1.45	0.8	$\frac{2235}{1399}$ ♂ Nat. Mus. collection, Lower Missouri.
4856	H. leucopus...............	......	2.55	1.20	0.8	4856 Nat. Mus. collection, Pennsylvania.
14904	H. Truei...................	♂	2.90	1.50	0.9	Collected by Dr. Shufeldt. From specimen in preceding table.
15130	Ochetodon humilis..........	♀	2.10	1.05	0.7	From last specimen in preceding table. Fort Wingate, N. Mexico.

It is evident, aside from other characters given below, that the extraordinary size of the ears of the mouse captured by me on the 16th of March, as well as the superior dimensions and varying ratios of the diameters of its skull, entitle it at least to distinction as a new species. It gives me pleasure, therefore, to bestow upon it the name of my esteemed friend Mr. F. W. True, curator of mammals, in the United States National Museum.

All of the specimens of *Hesperomys* loaned me for comparison by the National Museum have the upper parts of a bright yellowish-brown, inclining to a tan color, while the parts beneath are of a pure white, the line of demarcation between the two being very distinct. Now, all the specimens of *Hesperomys* from this region are of a *very pale*, dull clay color above, and white beneath, but the line of demarcation not so evident at first sight, in consequence.

The dental formula in True's mouse agrees with the *Murinæ* generally, being, incisors $\frac{2}{2}$ and molars $\frac{3-3}{3-3}$; we notice, however, in the specimen that the cusps of both the mandibular and upper molars have been entirely worn off, leaving a shallow, longitudinal groove along their upper surfaces, connecting the three crowns. I am unable to say at the present writing what this is due to, or how constant it may be. To decide this we must have a better knowledge of the character of the food of this mouse, as well as the opportunity to examine specimens of different ages.

H. leucopus of this region, inhabiting as it does the valleys, no doubt subsists upon the softer vegetable substances which give rise to but little abrasion of the molar teeth, whereas *H. Truei*, a species which has chosen the rocky mountain sides for its home, now lives upon the flinty piñon nuts, and the spiny leaves of the trees upon which they grow, and these substances may have something to do with the wearing down of the molar teeth. The implantation of their roots agrees in general with that observed in other members of the genus, and these non-visible parts are equally well developed in them.

In the mandible of *Hesperomys*, we find the condyle and the small coronoid process separated by a long, shallow, longitudinal valley (Figs. 7 and 8, pl. XXI).

Again, in *Hesperomys* the nasal processes of the maxillaries do not project behind the nasals, as they invariably do in *Neotoma* (Figs. 4 and 5, pl. XXI, *N. Mx.*, *N. Mx'.*). It is of interest to know also in regard to these two genera, that the ratios of the longitudinal and transverse diameters of the interparietal bones differ very markedly.

Hesperomys Truei, sp. nov.

True's Piñon Mouse.

DESCRIPTION.

(Adult male, in the flesh.)

A *Hesperomys* with a form more robust than in most others of the genus. Eyes large and capable of extraordinary protrusion when the animal is affrighted. Whiskers very long and many-haired. Ears presenting the normal generic characters, but remarkable for their unusual size. Upper halves are delicate, thin, and very sparsely covered with short, fine hairs. Fur rather longer than common, soft, loose, and flossy. Tail more thickly haired than in *H. leucopus*, and the hairs longer.

Color.—Upper parts of a yellowish brown with an admixture of black-

ish hairs, the latter best marked on the dorsum, becoming less so as we approach the sides. Sides bright fulvous. Entire under parts white, blending with the fulvous of the sides, the line of demarcation being by no means so evident as in *H. leucopus*. Upper sides of feet white. Tail bicolor; upper side blackish brown, white beneath. Manus and pes agree with *H. leucopus*.

Dental characters.—In the dental formula, as well as the method of implantation of the teeth, this animal agrees with *H. leucopus*, but in this, the type specimen, the crowns of the molars are peculiarly worn away, as described above. It will be interesting to examine other specimens with the view of looking into this subject, ascertaining, if possible, how far this condition is constant, and to what extent it may be due to age.

Cranial characters.—Although the skull presents in general the characters of the genus, it is considerably longer and larger in other ways than the skull of *H. leucopus*. (See table.) This increase in size has not been accompanied by an increase of strength or thickness of this structure; on the other hand, if anything, the skull of True's mouse is of a more attenuated and delicate composition than that of the common white-footed mouse. The basi-occipital is more emarginate also than in that species, and the periotic is quite different in form.

In the mandible we find that the symphysial portion is not bent up so abruptly as it is in all forms of *H. leucopus*, and in consequence the lower incisors are directed about equally forwards and upwards, while in *H. leucopus* these teeth are, in most specimens, curved almost entirely upwards. (Figs. 7 and 8, pl. XXI.)

The skeleton of *H. Truei* presents many characters, apparently of specific value, by which it may be distinguished from that of *H. leucopus*. The manubrium of the sternum is shorter in the former species than in the latter; the anterior margin of the scapula is larger and more sharply angulated, and the posterior margin straighter; the posterior margin of the pelvis is much more rounded; the transverse processes of the lumbar vertebræ are more slender, and those of the sacrals wider.

True's piñon mouse differs then from the common white-footed mouse, *H. leucopus*, in the fact that it chooses a different character of the country where it is found, as its home; in its more robust form; in its extraordinarily large ears; in important cranial and skeletal characters; and in a very marked degree in general coloration, though less weight is to be attached to this last difference than to any of the others.

At present little or nothing is known of the habits of this mouse; in these, however, it probably largely agrees with other field mice. Living in the mountainous and piñon-covered belts of this region; building its nest in the hollow trunks of trees; subsisting upon such food as the country would afford a small rodent, and hibernating during the winter months.

NOTES ON SOME APPARENTLY PREOCCUPIED ORNITHOLOGICAL GENERIC NAMES.

R.

By LEONHARD STEJNEGER.

1.

Usually we find Fleming quoted as the author who established the genus *Clangula*. The genus is adopted by Boie, however, also in 1822, who quotes Cuvier as the authority for the name.* Where the latter has published it I am unable to find, and the earliest date to which I can trace it is 1819, when it is applied by Leach for *Anas glacialis* Linn. alone, which species, therefore, must stand as the type, unless Cuvier's application of the name has the priority and a different type. As it seems that *Harelda* was not published until 1824, *Clangula* would have to supersede the latter. True, Gray (Hand-list III, p. 87) quotes "*Harelda* Leach, 1816," but it is certainly not in this author's "Systematic List," nor can I discover any reference prior to 1824.

Should *Harelda*, after all, turn out to have the priority over "*Clangula* Leach, 1819," *Clangula* being a strict synonym of the former cannot be used for the golden-eyes in any case. As all the subsequent generic names bestowed upon the latter group are preoccupied, a new name has to be chosen, for which I propose

GLAUCIONETTA.†

SYNONYMY.

<1822.—*Clangula* FLEMING, Philos. Zool., II, p. 260 (type *A. clangula;* nec LEACH, 1819).
=1829.—*Glaucion* KAUP, Entw. Europ. Thierw., p. 53 (same type; nec OKEN, 1816).
<1858.—*Bucephala* BAIRD, B. North Am., p. 795 (type *A. albeola;* nec *Bucephalus* BAER, 1827).

The species are:

Glaucionetta clangula (Linn.).
Glaucionetta clangula americana (Bp.).
Glaucionetta islandica (Gm.).

2.

The name which has been used as the generic term for the Spruce partridge and allied species is preoccupied in zoology, for as early as 1838 *Canace* was applied to a group of dipterous insects by Curtis, while

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* In the first edition of the Règne Animal (1817), he only defined the group under the French appellation, "Les Garrots"; the word *Clangula* is not used generically or subgenerically.

† *γλαυκιον*, glaucium; *νηττα*, anas. Type *Anas clangula* Linn.

for the bird it was not proposed until 1852. This will necessitate the adoption of Elliot's *Dendragapus*, if we consider the Dusky Grouse congeneric with the Spruce Partridge. For the subgenus embracing the latter, a substitute for *Canace* is necessary, and to avoid too great dissimilarity it may be called *Canachites*.*

THE CHACLACAYO TREPHINED SKULL.

By OTIS T. MASON.

In the Journal of the Anthropological Institute of New York for 1871–'72, Mr. Squier describes a skull which was taken from an Inca cemetery in the valley of the Yucay, within 1 mile of the Baths of the Incas. This skull is figured also in Mr. Squier's "Incidents of travel and exploration in the land of the Incas."† It has a square perforation on the left frontal prominence, made by the intersection of four furrows, cut probably with a stone implement. "In 1875, Mr. Henry Gilman, of Detroit, published in the American Naturalist‡ a description of ten or fifteen skulls obtained from mounds on Sable River, Lake Huron, and two fragments from Grape Mound, Rouge River, Michigan." Each of these skulls was perforated at the vertex, evidently done by boring with a rude, probably stone instrument, varying in size (in some instances having a diameter one-third of an inch; in others of one-half an inch, and flaring at the surface).§

In August, 1873, M. Prunieres made a communication, at the Lyons meeting of the French Association for the Advancement of Science, on cranial amulets.|| These amulets are roundish pieces of the human skull, some of them evidently taken out long enough before the death of the individual to allow a certain degree of healing.

In 1877 Dr. Paul Broca published an article in the Revue d'Anthropologie on the trephining of the skull and cranial amulets in the Neolithic period.¶ Between 1877 and 1882 several scattered communications were made upon the same subject before different societies in Europe. Dr. Robert Fletcher, of Washington, from whom most of this historical matter is taken, published in the fifth volume of Major Powell's Con-

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*Deriv., κανaχεω, to be noisy. Type, *Tetrao canadensis* Linn.

†Peru. Incidents of travel and exploration in the land of the Incas. By E. George Squier. New York. Harper's, 1877, p. 456; Appendix A, 577–580.

‡American Naturalist, Salem, 1875, IX, 73.

§Fletcher. "Prehistoric Trephining," 24; also Proceedings Am. Assoc., 24th meeting, pp. 316–331, and ibid., Nashville meeting, 1877, 335–339, both quoted by Dr. Fletcher. See also Holbrook in American Naturalist, 1877, XI, 688.

||Association Française pour l'Avancement des Sciences. Compte rendu 2me session. Lyon, 1873; Paris, 1874; p. 703. Also Bull. Soc. d'Anthrop. de Paris, 1874, 2 s., IX, 185–205.

¶Sur la trépanation du crâne, et les amulettes crâniennes à l'époque néolithique, par Paul Broca. Paris, 1877; also, Rev. d'Anthrop., Paris, 1877, VI, 1–42, 193–225; also, Congrès d'Anthrop. et d'Archéol. prehist., Buda-Pesth, 1876, 101–192.

tributions to North American Ethnology an elaborate paper upon the same subject, in which he brings together all that had been previously written.* His unparalleled advantages in becoming familiar with medical literature enabled him to exhaust the subject up to 1882. Since that time little of any account has been published. Dr. Fletcher discovered that in treating of this subject he had to deal with two entirely different sets of phenomena—the one had reference to the living, the other to the dead. He also tells us "there are three processes by which an opening in the cranium can be methodically produced—by rotary movement, by cutting [sawing?], and by scraping."

Trephining upon the living, if successful and the patient recovered, was followed by cicatrizing; if the patient died under the treatment, the wound would present scarcely a different appearance from the cut made upon the skull of the dead. It is more than probable, however, that even among savages a different method and instrumentation would be used in the two cases. There are on record accounts of surgical operations performed upon the living, even among very savage races. Dr. Fletcher makes allusion to several localities in which this practice exists. All of the examples of aboriginal trephining in America were more than probably *post mortem*. Those alluded to by Mr. Gilman in the American Naturalist, to which he has added several examples since, and the specimens figured by Mr. Squier, show no certain marks of cicatrizing.

The National Museum has recently received from Dr. W. H. Jones, U. S. N., the most remarkable specimen of *post-mortem* trephining which has yet come to light. It is a skull obtained from Chaclacayo, near Chosica, a mountain in Peru, near Lima, about 4,000 feet high. Three mummies—man, woman, and child—were obtained from one grave. From the same place were obtained several skulls of peculiar shape, including the one under consideration. The specimen belongs to the elongated Inca type. The section or roundel was taken from the center of the frontal bone, and the opening is about 2½ inches in length and nearly 2 inches in width. The outline of the cutting is a polygon. Eight distinct furrows are visible upon the surface of the skull. The work seems to have been done in the most bungling manner. One furrow must have been cut across the space longitudinally, and the parts on either side of this main furrow were taken away piecemeal, by a combination of furrows and fractures. At the extremity of some of the furrows scratches are visible, which seem to indicate that the bone was removed by means of a chipped stone implement.

It is impossible to conjecture the design of this singular custom. We are not able to say even whether the bone was taken out just previous to or after death. No rondelles or fragments of the bone removed have been found in this continent similar to those discovered by M. Prunieres.

* On Prehistoric Trephining and Cranial Amulets. by Robert Fletcher, M. R. C. S. Eng., acting assistant surgeon U. S. A., Cont. N. A. Ethnology, VI.

DESCRIPTION OF FIGURES, PLATE XXII.

FIG. 1. Inca skull from Chaclacayo, Peru. The specimen is so deformed as to admit of no delicate measurements, neither could the capacity be obtained. In addition to the usual deformation produced by bandaging, the occipital region is slightly bent to the left, and the nasal spine so completely warped toward the left as to be seen entirely in front of the orifice on that side. Length, 6.8 inches; width, 5.3 inches; bizygomatic width, 5.35 inches.

FIGS. 2 and 3. Plan of cuttings on the cranium. *a a'*, a gash 3 inches long, oblique to the antero-posterior vertical plane of the skull, and dividing the exsection into two unequal parts, the greater on the left side. It is hard to divine why this cut was made. It is not connected with the removal, for the curved cut *e e'* severs it above, while there is not the faintest trace of it below the surface in the cut *b b'* below. Its lower extremity is merely a scratch on the surface of the bone. *b b'*, a tolerably straight and effective cut obliquely across the lower right corner, looking with the skull. It is deep above, slight below, and penetrates the bone, except in a small space in the middle, where the inner table was fractured to remove the piece. (Seen better in Fig. 3.) By laying a straight edge in the cut, its lower margin reaches quite through, except in the short space just mentioned. *c c'*, a straight cut obliquely across the upper right-hand corner, shallow and barely perforating the upper table. The inner table has been violently broken by a series of irregular scallops, seen better in Fig. 3. *d d'*, a short furrow directly across the bottom or front of the cavity; upon the right its termination is very plainly marked, while its other extremity is scarcely visible. This cutting extends to the inner table, which shows signs of breaking, especially the upper portion of the ethmoid, (*k*. Figs. 2 and 3). A marked difference exists between this cut and some others, *b b'* for instance. The latter resembles the furrow of a straight-edged saw, the former, *d d'*, that of a stationary circular saw. The furrow is much deeper in the middle. *e e'*, this furrow should be carefully noticed. It commences in the upper right-hand corner, penetrates to the interior of the skull for half an inch, crosses *a a'*, and sweeps around by a curve toward the left. At this extremity it has three or four ends, and after crossing *a a'* the cutting was useless. The surgeon must have used the frontal bone as a center, and his hand as a radius, to give a circular motion to his implement. The outer side of this cut presents several ragged places, showing where the tool ran out. *f f'*, a straight, deep, and short furrow on the left side. At its lower extremity it is very plain, and its progress upward can be marked to *f*. Where it pierces the cranium it crosses two other furrows, *e e'* and *h h'*. The space from its upper extremity to the crossing of *a a'*, marked *l* in Fig. 3, has been broken off violently. *g*, this short, shallow furrow, between *e e'* and *l*, seems to have had no motive, and it may have been simply a running out of the implement in making the curved furrow *e e'*. *h h'*, this furrow is at the lower left-hand corner of the opening. Its terminations on the outer table are quite obscure, but it is the cleanest cut of all, penetrating through the cranium along its whole extent.

Thus, by a series of saw-cuts and breaks, this mass of bone, which by courtesy we may call a rondelle, was removed. It can hardly be said to throw light upon the problem, for it has introduced a complication of surgery quite unknown hitherto. I may be allowed to venture a guess that the somewhat quadrangular pieces which would result from the two operations, bounded by the cross line *a a'*, were wrought into some useful thing, like the point of an arrow or spear. Instances are not wanting among peoples of low civilization where human bones have been considered to have great potency.

ON THE PARASITES OF THE HESSIAN FLY.

BY C. V. RILEY, Ph. D.

Considering the number of articles that have been written upon the Hessian Fly (*Cecidomyia destructor*), very little of a critical and exact nature has been published concerning its parasites.

But two species have hitherto been described with any detail, although two others are mentioned by Herrick without identification, and without description sufficient to render them recognizable. In Europe the same uncertainty seems to exist. Even Dr. Balthazar Wagner, in his admirable paper,* gives very little that is definite concerning the parasites, and although he states that he sent specimens to Dr. Foerster, I am unable to find that this celebrated hymenopterist ever named them. The advantage of correct knowledge as to the habits of these parasites, and of being able to refer to them definitely, is apparent when we consider the importance of their host, which was conspicuous for its ravages on the wheat of New England in pre-revolutionary times and has recently crossed the Rocky Mountain range so as to threaten the wheat of the Pacific. During the past few years I have made a special study of these parasites, and will consider five of them in what seems to be the order of their importance. The figures accompanying this paper were prepared at the Department of Agriculture and are used here with the kind permission of Commissioner Colman.

Merisus destructor (Say).

[Plate XXI, fig. 1].

SYNONYMY.

Ceraphron destructor Say. Journal of the Academy of Natural Sciences of Philadelphia, vol. i, No. 3, pp. 45–48, read June 24, 1817. Say's Complete Writings, Le Conte edition, vol. ii, p. 6.

Eurytoma destructor (Say). Harris, a report on the insects of Massachusetts injurious to vegetation. Cambridge, 1841, p. 432.

"*One of the Eulophides.*" Westwood, Introduction to the Modern Classification of Insects. London, 1840, vol. ii, p. 160.

Pteromelas destructor (Say). Curtis. Journal of the Royal Agricultural Society. London, 1846, vol vi., p. 139.

Raphitelus, or *Storthygocerus destructor* (Say). Harris, *op. cit.*, 2d ed. Boston, 1852, p. 586.

Semiotellus destructor (Say). Fitch. Seventh report on the noxious, beneficial, and other insects of the State of New York. Transactions of the State Agricultural Society for 1861. Albany, 1862, p. 827.

It will be seen from this synonymical list that there has been much difficulty in properly placing this insect. Since Fitch placed it in the genus *Semiotellus* it has remained undisturbed, but in view of Thomson's recent studies of the Pteromalinae it is necessary to transfer *destructor* to his genus *Merisus*.

* Untersuchungen ueber die neue Getreidegallmücke. Fulda, 1861. Translated by Dr. Carl Gissler, it appears as an appendix to the Third Report of the United States Entomological Commission, p. [8]. Washington, 1883.

This species would seem to be the most abundant of any of the parasites of the Hessian Fly, judging from the records of previous authors. Packard, in his bulletin on the latter insect,* has collected statements concerning the numbers in which these parasites occur. He quotes Herrick to the effect that probably nine-tenths of every generation of the Hessian Fly is destroyed by parasites, this species constituting the larger proportion. He also quotes a Michigan correspondent, who stated that in 1877 the Hessian Fly in Kalamazoo County was nearly exterminated by the "Semiotellus," nearly all the "flaxseeds" being destroyed by it.

The relative abundance of this and the other species of the same genus is, however, in all probability, a question of latitude or location, for, in the breeding from infested wheat received from Missouri, the species descriped as *subapterus* in this paper has been much the most common.

The eggs of this parasite are without much doubt deposited in the half-grown larvæ of the Hessian Fly early in the spring, and in the more southern portions of the wheat belt there are in all probability two generations, the first issuing from the puparium in April and May, and the second issuing all through the summer and fall. Many, judging from my experience in-doors, hibernate in the pupa state within the Cecidomyid puparium, and cut their way out the following spring. In the North, however, there seems to be but one annual generation.

The so-called puparium is at first really nothing but a rigid, quiescent larva, corresponding to what I have called the coarctate larva in the Meloïdæ, and it will help to prevent confusion if we do so designate it in the Hessian Fly, up to the period when the real pupa is formed within it, for it must not be forgotten that another soft and final larva stage is assumed within this coarctate larva shell, and lasts much longer than the pupa state proper. I would restrict the term puparium in this case to the period during which the pupa proper dwells within it.

Whether or not there exist wingless individuals of this species becomes extremely doubtful. So far as my own breeding is concerned, none have been obtained. Harris makes no reference to them, nor does Packard in his description of the species. Say makes no reference to them in his description proper, but in the note† which Mr. Howard has called attention to as having been omitted from the Le Conte edition,‡ he remarks that the parasite "throws off its wings as a useless incumbrance," &c. So far as I am aware this habit does not occur in any of the species of the family and there has certainly been no tendency in that direction among the specimens that have come under my observation.

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* Bull. 4, U. S. Entomological Commission, Washington, 1880. Reprinted, with additions, in the third report U. S. E. C., Washington, 1883.

† Journal of the Academy of Natural Sciences of Philadelphia, July, 1817, vol. i, p. 63.

‡ See *Psyche*, vol. iv, p. 206. August, September, 1884.

Herrick also disproved Say's explanation, but was in doubt whether or not to consider the wingless individuals that he observed as belonging to the same species. He says: "At page 63, it is stated that the so-called *Ceraphron destructor* throws off its wings, &c. This is not true. I have kept many of them six weeks without any such results, and never saw anything in my intercourse with them which induced me to suspect it. But it is certain that many of them are evolved with only rudiments of wings. I have seen them come out of the puparium in this state. This apterous animal is so similar to the female that I have considered it the same species; but I hardly know how to consider it. In the field I have never seen these apterous ones ovipositing or *in coitu*. Are they neuters, and if so, for what use?"

The question is answered by the existence of the other species described in this paper, which, as will be seen, is apterous as a rule, and winged only as an exception, and which was evidently mistaken by both authors for wingless specimens of *destructor*. In order to properly separate this last I have drawn up a full description, which will show its distinctive characters as compared with other allied species.

DESCRIPTIVE.

Merisus destructor (Say).

Male.—Length (average) 1.98^{mm}. Expanse of wings 3.25^{mm}. Greatest width of fore wing 0.62^{mm}. Antennæ long filiform, strongly pilose; funicle joints sub-equal in width, decreasing slightly in length from 1 to 6; joint 1 a little more than twice as long as broad; the club is nearly as long as the two preceding joints of the funicle together, ovate, flattened on the sides and acuminate at tip. The ocelli are large and prominent. Head and notum densely and rather finely punctate, the punctures on the mesoscutellum and metanotum finer than those on the head, pronotum and mesoscutum, those on the metanotum being deeper; metanotum with an indication of a median carina. The abdomen is oval, convex above, flattened below, glabrous, but very finely shagreened. The hind tibiæ have but a single apical spur, and the hind trochanter has two very minute tooth-like projections below. General color black; antennal scape yellowish, pedicel and flagellum brown to blackish, pedicel often yellowish below; head and thorax with a bluish-green metallic reflection; all coxæ black with metallic reflections; all femora black or dark brown, with yellowish tips; all tibiæ and tarsi honey-yellow. Wings perfectly hyaline; wing veins very distinct, dark brown in color; spurious veins more distinct than in *M. destructor*. Abdomen black with a yellowish spot varying in size above and below at base.

Female.—Averages in size a little larger than the male, from which she differs principally in the antennæ, which are short and have a slight clavate tendency; the funicle joints increase slightly in width and decrease slightly in length from 1 to 6; club short and obliquely acuminate; scape short, light yellow-brown in color; flagellum brown; club lighter in color than the remainder of the flagellum; pile very short and fine.

Described from 4 ♂'s, 10 ♀'s.

Differs from all other described species of the genus in the combination of the pale scape, hyaline wings, and flattened abdomen.

There can be little doubt that this is the species described by Say and elaborated by Fitch. Say's description is of a very general character, but there are two points in it that would seem to settle the question as between this and *subapterus*. The fact that he had both sexes

is made evident from the reference to the male and some of its distinguishing characters. His description therefore makes the antennæ in both sexes pale brown, and, by inference, the legs, with the exception of the tarsi, are dark. The only valid reason to question the species intended by him is his subsequent reference to the wingless form; but we must assume that, like Herrick, he looked upon his wingless individuals as probably the same species without very critically using them for descriptive purposes.

Fitch's description, while quite lengthy, is lacking in a remarkable degree in important structural characters, but his description of the legs supplements Say's and makes it, in connection with other characters given, quite evidently apply to the species under consideration.

Packard's description is largely a repetition of Fitch's with some additional statements as to the coloration of the legs which, together with his statement that the antennæ are black, make it somewhat doubtful as to the species intended. There is, however, some variation in the color of the antennæ which might well be called black in some specimens, especially upon hasty examination.

No wingless individuals of this species have been found. A number of specimens were bred between May and August, 1880, from wheat-stalks received from Mr. E. J. Chiswell, Dickerson's, Md. In each case the parasites issued from the coarctate larva, and in no instance more than one Chalcid each. From wheat sent by Mr. Barlow, from Cadet, Mo., in the spring and summer of 1883, two females of the species issued, one in July and one in August, and in April two more females and two males issued from the straw, in company with many specimens of *M. subapterus.*

Mr. L. O. Howard would place this species in the genus *Merisus* with which it seems to have considerable affinity, although it possesses certain characters which would exclude it according to Thomson's rigid definition. Thus the abdomen approaches much more nearly that of *Dimachus*, while the rudimentary median carina of the metanotum would place it between this latter genus and *Merisus*. It is a well-marked form, and may rest quietly in this genus until the American Pteromalinæ are thoroughly studied as a whole.

Merisus (Homoporus) subapterus, n. sp.

[Plate XXI, fig 2.]

Wingless male.—Length varies from 1.58^{mm} to 2.74^{mm}. Antennæ inserted a little below the middle of the face, their bases close together, but still distinctly separated; scape reaching to the ocelli; flagellum short, finely pilose, club oval-acuminate, flattened laterally; joints of the funicle subequal in length, joint 1 a trifle longer than broad, the rest increasing very slightly in width to joint 6, which is as wide as long. Cheeks well rounded; ocelli in a curved line, middle ocellus indistinct; head considerably broader than thorax, densely and finely punctate. Pro- and mesonotum with punctation similar to that of the head; metanotum rounded, with somewhat larger and deeper punctures. Abdomen ovate, acuminate, not flattened, perfectly glabrous. Color: Head and thorax with a dark-greenish metallic luster; bulla of antennæ black, scape and pedicel honey yellow; flagellum yellow-brown, often with

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a darker metallic tinge, especially at joints, causing the flagellum in some instances, particularly in the smaller individuals, to appear dark; pile whitish; all legs honey-yellow; coxæ very slightly metallic at base; tarsi, and sometimes distal end of tibiæ, whitish; abdomen black; penis (often extruded to a considerable length) brown.

Female (winged and wingless).—Length varies from 1.8^{mm} to 2.8^{mm}; average wing expanse, 3.75^{mm}. Differs from male in the following respects: The antennæ are more clavate, the sixth funicle joint slightly broader than long; the flagellum is always black, with a slight metallic tinge, and the pedicel is usually tipped with black at its distal end; the pile is much shorter and finer than in the male. The femora and the tibiæ are in general of a darker brown, in which case the knees and the distal third of the tibiæ are whitish. The metallic luster of the thorax is more subdued, and the abdomen has the characteristic female notch when seen from the side. The wings are perfectly hyaline, and the veins are only faintly tinged with yellowish; the spurious veins are very faintly perceptible.

Described from many ♂ and ♀ specimens, only 3 of the latter being winged. All bred from final larva of the Hessian Fly, collected at Cadet, Mo., by J. G. Barlow, and issuing through the coarctate larva shell.

Distinguished from other described species by the contrasting antennæ in the sexes and by the ovate abdomen which, when fresh, has no flattened dorsal surface.

There can be no question but that the wingless and winged individuals are specifically identical. The proportion of the wingless to the winged varies at different seasons and in different parts of the country. Thus from a lot of puparia of the Hessian Fly, received in the summer of 1883 from Missouri, there issued 31 wingless males, 28 wingless females, and 3 winged females. Of these, about one-third issued from the straw in August, 1883, and the rest, including all the winged individuals, hibernated in the straw and issued in April and May, 1884.

While, as the descriptions show, there are many very important points of difference between these two species—points that would even separate them subgenerically and, according to some authors, generically, the distinguishing features that will be most readily observed by casual examination are as follows:

Destructor is on an average of smaller size; more uniformly metallic in color; has a flatter abdomen, with yellowish spot at base; has the antennæ similar in both sexes (generally darkest in the male), and either pale-brown or blackish-brown; has the coxæ metallic-black, the femora brown or black, except toward tip; the paler parts of legs whiter than in *subapterus*. It does not, so far as we now know, occur in the apterous condition.

Subapterus is on the average larger; of darker color and less metallic, with the flagellum of the antennæ pale in the male and black in the female; the abdomen much more rounded and without pale spot; the coxæ, trochanters, femora, and basal part of tibiæ honey-yellow. It occurs mostly in wingless condition.

The jaws are brown in both sexes, but more conspicuously so in *Subapterus*.

Eupelmus allynii (French).

[Plate XXI, figs. 3 and 4.]

SYNONYMY.

Isosoma allynii French. Canadian Entomologist, vol. xiv, p. 9. (January, 1882.)
Eupelmus allynii (French). Riley, American Naturalist, vol. xvi, p. 247. (March, 1882.)

This species was originally published by Prof. G. H. French as a wheat depredator of the genus *Isosoma.* Specimens which he sent me, however, soon after his publication of the species, showed that it belonged to *Eupelmus* and not to *Isosoma*, and that, therefore, it was a parasite and not a plant-feeder. The question at once arose: "Upon what is it parasitic?" Professor French answered this question as follows: "The genus *Eupelmus* is parasitic as far as known, and I presume *E. allynii* is no exception. I may say that I have obtained another specimen of this species from a gall in a stalk, produced evidently by the regular joint-worm (*Isosoma hordii*). From this and from the fact that my specimens were obtained from burrows made in the wheat-stalks by this new *Isosoma*, it seems to me that we have here a parasite on the real wheat-stalk worm. * * * It should be borne in mind, also, that the *Eupelmus* is a probable destroyer of the real wheat enemy.* In the annual report of the U. S. Entomologist for 1881–'82, I wrote (p. 186): "Although we cannot yet say with certainty that *Eupelmus allynii* is parasitic upon our wheat Isosoma, yet, considering the circumstances under which it was obtained, this seems probable." Prof. S. A. Forbes also remarks: "Professor French found *Eupelmus allynii* also in the straws, thus confirming the hypothesis of its parasitism on Isosoma." † It is thus rendered quite certain that *Eupelmus allynii* is parasitic on *Isosoma*, and I was able to confirm the evidence quoted by subsequently breeding the parasite from *Isosoma hordii* received from Mr. E. C. Brooke, of Cuckoo, Louisa County, Virginia, and but a few days later a large series was raised from straw containing only *Isosoma tritici*, received from F. M. Webster, Oxford, Ind. There can, therefore, be no question but that the species is parasitic upon both *Isosoma hordii* and *I. tritici.*

While, therefore, there can be no doubt about the real parasitism on *Isosoma* there is just as little doubt as to its being parasitic on the Hessian Fly; for I find that two specimens (both females) were bred by me from coarctate larvæ of the Hessian Fly on July 18, 1876, at Saint Louis, Mo., the straw having been received from the interior of

* Eleventh Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. By Cyrus Thomas, Ph. D., Springfield, 1882, p. 81, foot note.

† Thirteenth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. S. A. Forbes, Springfield, Ill., April, 1884, p. 34.

the State. Three other specimens, consisting of one male and two females, were also bred at Washington, July 31, and August 8, 1883, from coarctate larvæ received a few weeks before from Mr. J. G. Barlow, of Cadet, Mo.

That there can be no question as to the identity of the parasite I will state that the specimens just mentioned were carefully compared, not only with Professor French's description, which might leave a doubt, but also with type specimens of both sexes received from him.

In the genus *Eupelmus* there is great want of uniformity of habit in regard to host, while in most other Chalcid genera the uniformity in this respect is very marked. On account of this polyphagic habit, as well as by virtue of its other peculiarities, the genus long ago interested me, and I have obtained it from Lepidopterous eggs, from Orthopterous eggs, from Hemipterous eggs, from Cynipid galls, from Cecidomyid galls, from Lepidopterous larvæ, from Coleopterous larvæ, and from free Cecidomyid larvæ.

I am not aware that this species has ever before been bred from the Hessian Fly, although it may be the fourth parasite mentioned so indefinitely by Herrick.*

Tetrastichus productus n. sp.

[Plate XXI, fig. 5.]

This species was bred in considerable number March 31, 1884, from coarctate larvæ sent by Mr. Barlow from Missouri the summer previous. It is impossible from the evidence we possess to say with certainty whether this species is really a parasite upon the Hessian Fly or whether it is a secondary parasite, having some one of the other parasites as its proper host. This is always an extremely difficult point to determine, in considering any insect from which several species of parasites have been bred. In such cases all of the parasites have usually been described as *primary*, *i. e.*, true parasites of the species from which they were reared; but the habits of the genus, so far as known, should guide us in our conclusions, in default of absolute data or direct observation. Several cases have come under my notice in which *Tetrastichus* was without question a secondary parasite and several more are given by Giraud and Laboulbéne.† From these facts I am strongly inclined to believe that the species of *Tetrastichus* are usually, if not invariably, parasitic upon the smaller Hymenoptera belonging to the Chalcididæ, Cynipidæ and Braconidæ, and I am thus inclined to consider *T. productus* not as a parasite of the Hessian Fly, but a secondary parasite feeding upon some one of the others, and probably upon *Merisus destructor*.

* American Journal of Science and Arts, vol. xli p. 155. New Haven, October, 1841.

† Liste d'Eclosions d'Insectes. Ann. de la Soc. Ent. de France, t. vii, Sér. V, pp. 433, 444 (1877).

DESCRIPTIVE.

Male.—Average length, 1.5mm; wing expanse, 2.6mm; greatest width of fore wing, 0.5mm. Scape somewhat broadened below, inserted near the middle of the face in a deep groove, and reaches nearly to the ocelli. Flagellum long, flattened, hairy, each joint except club with a whorl of long slender hairs at base. Funicle joints decreasing in length slightly from 1 to 4, joint 1 rather more than twice as long as wide. Head considerably shrunken after death. Head, pronotum, and mesonotum smooth and shining; metanotum, pro, meso, and metapleura, and all coxæ above, finely punctate. Submarginal vein of the fore wing with a single stout superior bristle behind its middle; marginal vein three times as long as stigmatal; post-marginal wanting. Median impressed line of mesosternum very distinct; metanotal carina distinct, rather short. Abdomen narrow, compressed laterally, sub-acuminate. General color shiny black, with slight metallic reflections; flagellum, brown; all trochanters, distal end of all femora, all tibæ, and tarsi, honey yellow; wing veins, brown, very distinct.

Female.—Length (average), 2.1mm; wing expanse, 3.2mm; greatest width of fore wing, 0.55mm. Scape slender, pedicel ovoid, ring joints very small; flagellum rather short, but slightly compressed; club ovate; funicle joints subequal in size, joint 3 rather shorter than 1 and 2, its length exceeding its width but slightly. Abdomen narrow, flattened dorso-ventrally, prolonged to an acute tip.

Described from six males and seven females.

Belongs in the first division of section 1 of Thomson's revision of the genus, and is more nearly related to *T. scaposus* than to other species, chiefly on account of the dilation of the ♂ scape, but from this it is at once separated by the produced abdomen of the ♀.

Platygaster herrickii Packard.

[Plate XXI, fig, 6.]

SYNONYMY.

Platygaster error Fitch (?) Packard. Bulletin 4, U. S. Entomological Commission, pp. 20, 21; Washington, 1880. Third Report U. S. E. C., pp. 219, 220; Washington, 1883.

Platygaster herrickii (?) Packard. *Ibid.*

In Bulletin 4 of the United States Entomological Commission Dr. Packard gave a description of a parasite received from Prof. A. J. Cook, which had been bred from the coarctate larva of the Hessian Fly. This parasite he identified doubtfully as the *Platygaster error* of Fitch, stating that if later it should prove to be a different species it might be called *Platygaster herrickii.* I adopt this latter name for the reason that Fitch's description is so very indefinite that it will apply equally well to almost any species of the genus, and that, inasmuch as *Platygaster error* was bred by Fitch from the eggs of a Heteropterous insect, it was in all probability different from this Hessian Fly parasite.

Concerning this parasite Professor Cook, in his lecture on the Hessian Fly, says:

"One of the parasites of the genus *Platygaster* is an egg parasite, as its young feed on the eggs—mere specks as they are—of the Hessian Fly.

"It is black and looks not unlike a tiny gnat. The female feels for the eggs with

her antennæ, and when found intrudes the fatal egg, which I find takes three-fourths of a minute, full three times as long as it takes the Hessian Fly. The little parasite is much longer, too, in finding the eggs than the fly is in laying them. I find that each egg receives one, two, or three of the parasite's eggs. The eggs of these latter are tardy in hatching, so that the larva of the parasite may feed on the maggot of the Hessian Fly, not her eggs. These pupate in the puparium of the fly."*

Dr. Packard considers it probable that this insect is the same species as Herrick mentions and speaks of as follows:

"The insect is abundant in the autumn. I first saw it September 23, 1833, in the act of depositing its eggs in the eggs of the Hessian Fly. From subsequent observations it appears that four or five eggs are laid in a single egg of the Hessian Fly. The latter egg hatches, and the animal advances to the pupa state as usual, but from the puparium no Hessian Fly ever comes forth. The parasite forms within the puparium a silky cocoon of a brownish color."†

There is probably some error in the above recorded observations. It is contrary to all precedent, as remarked by Mr. Howard in a note to page 219 of Dr. Packard's article, just quoted, that a female *Platygaster* should oviposit in an egg, and, even allowing such a possibility, it is highly improbable that an egg so pierced would hatch and the *Platygaster* imago issue only from the coarctate Cecidomyia larva, as parasitized eggs so far as we now know do not hatch. We should be slow to reject asserted observation, however opposed to general rule, but in this case verification is very desirable on account of the soft nature of the Cecidomyia egg and its general resemblance to the young larva.

The twenty-two specimens of this species which I have studied were all bred in March, 1884, from the puparia of the Hessian Fly which were received in August, 1883, from Mr. Barlow, of Cadet, Mo.

The Hessian Fly in Europe is also parasited by one or more species of the genus *Platygaster*, and Dr. Packard has received specimens, which I have examined, from Prof. Ferdinand Cohn, of Breslau. These are so badly mutilated, however, that nothing more than the genus could be determined. It is evidently a different species from *Pl. herrickii* and is considerably smaller.

It will be unnecessary to give a detailed description of *herrickii*, as Dr. Packard has already decribed it at length in Bulletin 4 of the United States Entomological Commission, and also in the third report of the commission. The description is recognizable, but the figure given in both of these reports is taken from Fitch, and is so poor that I have had a new figure made (Pl. XXI, Fig. 6).

A single female *Tetrastichus* was sent to me last June as a parasite of the Hessian Fly, by Prof. S. A. Forbes. It differs from *T. productus*, and he has given it the indistinctive MS. name of *carinatus*, but there is the same question as to whether it is a primary or secondary parasite which I have raised in speaking of *productus*. It is smaller than *pro-*

*Sixteenth Annual Report of the Secretary of the State Board of Agriculture of the State of Michigan (1877), p. 375.

† American Journal of Science and Arts, xli, 153–158 (October, 1841).

ductus, from which it strikingly differs in its bright lemon-yellow legs, in its shorter and less produced abdomen, and in other less obvious characters. But two other ♀'s were bred, so that the ♂ is unknown.

Finally, I have reared a single *Microgaster* from straws infested with Hessian Fly, but as there is doubt about its parasitism on this insect I omit consideration of it for the present.

DESCRIPTION OF LEPTOPHIDIUM CERVINUM AND L. MARMORATUM, NEW FISHES FROM DEEP WATER OFF THE ATLANTIC AND GULF COASTS.

By G. BROWN GOODE and TARLETON H. BEAN.

Leptophidium cervinum, n. s.

The type (No. 28764, U. S. National Museum), an individual 262^{mm} in length, was taken at "Fish Hawk" station 941, latitude 40° 01′ N., longitude 69° 56′ W., at a depth of 76 fathoms.

Description.—Body elongate, slender, its greatest height (25^{mm}) 10½ in its total length.

Head slender, somewhat compressed, its length (40^{mm}) 6½ in total length. Interorbital area broad, convex, its width equal to the length of the snout and 5⅔ in head's length. Snout sharp, conical, armed with a short but sharp spine, and somewhat overhanging the mouth. Eye circular, its diameter (10^{mm}) 4 in head's length, and much exceeding the length of the snout. Maxilla extending nearly to the vertical through the posterior margin of the orbit, its length (15^{mm}) three-eighths of head's length. Mandible extending behind the same vertical, its length (18^{mm}) equal to that of head without its postorbital portion. Jaws, vomer and palatines with narrow bands of villiform teeth, some of which are noticeably enlarged (*not movable*). Pseudobranchiæ present. Gill-rakers short, 8 below angle of first arch, 4 of which are rudimentary, the longest (2^{mm}) 5 in diameter of eye. (In *L. profundorum* the gill-rakers are slenderer and longer, though about equally numerous on the first arch.)

Scales in about 11 rows from the origin of the dorsal to the median line of the body.

Ventrals with length (13^{mm}) 3 in that of head.

Dorsal origin far back, at a distance from the snout (55^{mm}) 4¾ in total length; at a distance from the eye equal to head's length. (In *L. profundorum* this distance is two-thirds of the head's length and the first ray of the dorsal is nearly over the middle of the extended pectoral; in *L. cervinum*, over its tip, or nearly so.)

Anal origin with distance from snout (84^{mm}) 3 in total length. Length of pectoral (19^{mm}) 2 in head's length and 13 to 14 in that of body (10 in *L. marmoratum*, 11 in *L. profundorum*).

Scales ornamented with radiating striæ, covering densely all parts of the fish except the snout and under surface of the head and the fins. Lateral line continued almost to the end of the tail.

Color brownish-yellow, with numerous subcircular spots of white, with diameter half that of eye along the upper half of the body. Vertical fins with narrow black margin.

Specimens have been collected by the Fish Commission steamers at the following stations:

Number.	Station.	North latitude.	West longitude.	Depth in fathoms.	Number of specimens.
28764	941	40° 01′	69° 56′	76	11
28955	1036	39 58	69 30	94	1 *yg*
32653	2004	37 19 45″	74 26 06″	102	1
37235	2298	35 39	74 52	80	1
37236	2309	35 43 30	74 52	56	8

Leptophidium marmoratum, n. s.

The type (No. 37237, U. S. National Museum), an individual 198^{mm} in length, was taken at Albatross station 2350 north latitude 23° 10′ 39″ west longitude 82° 20′ 21″, at a depth of 213 fathoms.

Description.—Body somewhat elongate, stoutish anteriorly, gradually tapering, its greatest height (27^{mm}) 7⅓ in total length.

Head thickish, its length (39^{mm}) 5 in total length. Interorbital area broad, convex, its width nearly equal to length of snout, which is very slightly less than 5 in head's length. Snout blunt, spineless. Eye circular, the diameter (10^{mm}) 4 in head's length and somewhat exceeding the length of the snout. Maxilla extends to the vertical through the posterior margin of the orbit, the mandible far beyond, its length equal to that of postorbital portion of head. Teeth on vomer and in the jaws in villiform bands, the outer series in the latter slightly enlarged. Pseudobranchiæ present. Gill-rakers short, 8 below angle of first arch, the longest less than one-half diameter of eye. Branchiostegals 7. Ventrals with length (22^{mm}) as long as postorbital part of head.

Dorsal origin at distance from snout (44^{mm}) contained 4½ in total length, with 28 rays in a space equal to length of head, counting from the origin of the fin.

Anal origin separated from snout by distance (76^{mm}) 2⅔ in total length.

Length of pectoral (19^{mm}) 2 in head's length, or 10 in total.

Scales closely imbricated, ornamented with delicate concentric striæ. Lateral line apparently complete, about one-fourth distance from dorsal to ventral outline.

Color, yellowish gray, marbled along the entire upper half of head and body with olive brown. Dorsal and anal fins with black margins.

Leptophidium profundorum, Gill.

Specimens of *Leptophidium profundorum*, Gill, were obtained from the following stations:

Number.	North latitude.	West longitude.	Depth.
			Fathoms.
2378	29° 14′ 30″	88° 09′ 30″	68
2402	28 36 00	85 33 30	111
2350	23 10 39	82 20 21	213

NOTICE OF RECENT ADDITIONS TO THE MARINE INVERTEBRATA OF THE NORTHEASTERN COAST OF AMERICA, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES AND CRITICAL REMARKS ON OTHERS.

PART V.—ANNELIDA, ECHINODERMATA, HYDROIDA, TUNICATA.

By **A. E. VERRILL.**

ANNELIDA.

Polynoë Acanellæ Verrill.

Verrill, Trans. Conn. Acad., vol. iv, p. 324*b*, pl. 6, figs. 5, 5*a*, 1881; pl. 14, figs. 9, 9*a*, 9*b*.

Verrill, Report U. S. Fish Com. for 1883, [p. 23], pl. 39, figs. 172, 172*a*, 172*b*, 172*c*, 1885.

Body elongated, strongly depressed, moderately wide, widest at about the anterior third, tapering to the posterior end, composed of about sixty-five setigerous segments. Scales thin, nearly smooth to the naked eye, moderately large, but usually leaving the middle of the back uncovered, broad-ovate or roundish in form, with a smooth, even margin. The surface under a microscope shows numerous minute, blunt, subconical papillæ, of nearly uniform size. Head broader than long, with the sides well-rounded, narrow posteriorly, strongly bilobed in front, the lobes terminating anteriorly in small, conical papillæ. Eyes large, dark blue, the anterior ones about opposite the posterior base of the middle antenna; the posterior pair a little behind the middle, looking a little backward. Median antenna rather long, the length equal to about three times the length of the head, slender, with a rather stout basal article. Palpi stout, gradually tapered to the acute tip, smooth, of about the same length as the median antenna. The two upper tentacular cirri are of nearly the same length as the palpi, but much more slender; the inner ones are much smaller, scarcely more than one-third the length of the palpi. The ventral cirri of the first segment are long and slender, about as wide as the median antenna, and about three-fourths as long. The proboscis is large, usually exsert in preserved specimens, dark brownish purple in color, with eighteen marginal, pale purple papillæ, centered with a dark purple line. Dorsal cirri long, slender, smooth, delicately tapered, extending beyond the ends of the setæ. Ventral

cirri much shorter, gradually tapered, small, acute, reaching a little beyond the end of the setigerous lobe. The setæ are numerous, in moderately large clusters; the dorsal fascicles are much smaller than the ventral, with much shorter setæ, which are scarcely more than one-fourth as long as the ventral ones on the posterior segments and about a third as long on the anterior ones. The dorsal setæ radiate in different directions, while the ventral setæ are in two groups which are only a little divergent. In the preserved specimens the dorsal setæ are often angular or have the sides more or less concave toward the tips; they are crossed by numerous rows of very minute spinules, which do not extend quite to the acute tips. The ventral setæ have a slender, smooth shaft, with a somewhat broader, lanceolate, terminal portion, which is closely and sharply spinulated on one side along the broadest part, but naked and a little incurved at the acute tip; the lowest ones are smaller and have the terminal portion more bent. The diameter of the largest of the dorsal setæ is about equal to the broadest portion of the ventral setæ. The color of the setæ is translucent, pale amber. The scales are translucent, pale yellowish white, usually more or less specked or stained with pale orange-brown, and with a somewhat brilliant iridescence in certain lights. The body in the preserved specimens is yellowish white or pale salmon, with the parapodia a little paler; sometimes the median dorsal portion of the segments is tinged with purplish brown.

Length of the largest specimens, in alcohol, about 75^{mm}; greatest breadth, not including setæ, 10^{mm}; with setæ, 15^{mm}; breadth of head, about 1.5^{mm}.

This species is very abundant on the Gulf Stream slope, off Martha's Vineyard, in deep water, wherever *Acanella Normani* is found. It lives among the close branches near the base of this coral, a dozen or more frequently occurring on a single *Acanella*. Most of the specimens when obtained had cast off many or all of their scales, and many of them had lost their posterior segments.

This species is readily distinguished from most of our other species of *Polynoë* by the very elongated form of the body, composed of an unusual number of segments, and the large, dark purple proboscis. It resembles, in general appearance, *P. spinulosa* V., with which it is often associated, more than any other species.

Stations 894 and 895, in 365, 238 fathoms, 1880, abundant. Also from numerous other stations in 146 to 500 fathoms, in later years.

Polynoë aurantiaca Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 14, figs. 8, 8*a*, 8*b*.
Verrill, Report U. S. Fish Com. for 1883, [p. 23], pl. 40, figs. 173, 173*a*.

Body large, stout, broad, tapering somewhat posteriorly, composed of 35 to 37 setigerous segments, covered entirely with 16 to 18 pairs of smooth, thin scales, of which the last two pairs are very small; the first pair rounded; the rest broad reniform. Color bright orange-red, when

living. Head small, prominent, convex above, rounded laterally, narrowed posteriorly and in front; the lateral lobes pass directly into the basal article of the lateral antennæ, while the base of the median one is scarcely larger, and directly between them. Eyes blue, situated on the convex lateral surfaces of the head; the anterior ones are a little the larger, looking outward and slightly forward, the posterior ones looking outward and backward. Antennæ remarkably small, smooth, acute; the median one, with its base, is scarcely longer than the head; the lateral ones are about one-fourth shorter. Tentacular cirri also small, the long one rather larger and nearly twice as long as the median antenna, and exceeding the length of the head, smooth, with acuminate tip. The other cirri are similar to the lateral antennæ in size and appearance, and, like them, are tipped with dark pigment. Elytra are borne on segments 1, 3, 4, 6, 8, . . . 22, 25, 28, &c. They are large, broad-reniform, very thin and soft, translucent, perfectly smooth and without fringe. Dorsal cirri well-developed, resembling the large tentacular cirri in size and appearance, abruptly acuminate at the tip, and scarcely smaller below it. Parapodia large and stout; setigerous lobe of the lower ramus with two swollen lips, giving exit to a small upper fascicle of slender, acute, sparingly serrulate, golden setæ, and a few lower ones, which are stouter and nearly smooth. Upper ramus represented by a small rounded papilla, without setæ. Ventral cirrus small, short, acute, tipped with brown. Ventral papillæ small, but distinct, at the origin of the parapodia. Posterior segments and appendages very small. Length 40 to 50^{mm} or more.

Lives among the tentacles of large actinians (*Bolocera Tuediæ*).

Stations 879 and 880, in 225 and 252 fathoms, 1880, and at numerous other localities in subsequent seasons, in 160 to 317 fathoms.

Leanira robusta Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 14, figs. 10, 10*a*, 10*b*.

Verrill, Report U. S. Fish Com. for 1883, pl. 41, fig. 173, 1885.

Body large, stout, tetragonal, resembling *Leanira tetragona*. Parapodia with a large dorsal branchial lobe, rather longer than the setigerous lobe, from which it is separated by a rather wide interval, which is covered by large cilia. Upper setigerous lobe rather small, lanceolate, nearly as long as the lower, with a short dorsal cirrus, and with a superior cluster of slender cirriform processes. Lower setigerous lobe much larger and broader than the superior one, blunt at the tip, with a slender ventral cirrus, a large superior and a small inferior group of cirriform processes. Dorsal setæ very slender, a little enlarged and spinulose on each side, near the end, and tapered to a very acute tip. Ventral setæ much stouter and somewhat longer, with a slender, tapering, very acute terminal article.

Stations 873, 876, 877, off Martha's Vineyard, in 100 to 126 fathoms, 1880, and at several other stations in subsequent years.

Amphinome Lepadis Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 23, fig. 3.

Body stout, appearing squarish, broadest in the middle, tapering both ways, convex above. Head small, slightly bilobed in front. Caruncle cordate, as seen from above, with thickened edges, the emargination in front at the origin of the middle antenna; two front antennæ orange, directed forward, tapered, subacute, about equal in size and length to the median, and about equal to the breadth of the head, or buccal segment, two lateral antennæ stouter, rather shorter, bent downward. Two first setigerous segments have no gills, but below the setæ in each ramus is a cirrus; the upper ones are like the antennæ in size and length, and as long as the setæ; ventral ones smaller, tapered, all orange, with pale tips; setæ white, brittle. Branchiæ begin on the third setigerous segment. They are large and finely arborescently branched; color deep brown, with orange tips; stems short, dark brown. Back dark purplish brown, with bluish luster.

The largest specimens are 70^{mm} to 100^{mm} long; 12^{mm} broad.

Taken on floating timber in the Gulf Stream, among goose-barnacles (*Lepas*). In confinement it continually crawled in and out of *Teredo* burrows.

Leodice Benedicti Verrill, sp. nov.

This species somewhat resembles *L. polybranchia*, but is more slender in form, much less thickened anteriorly. It has much fewer branchiæ, which do not extend to the middle of the body. The superior antennæ are much longer and more slender. The buccal segment is much smaller and shorter.

The body is moderately large, not very stout, broadest along the anterior third, narrowing toward the head and gradually tapering toward the tail. The anterior segments, back to about the eighth, are strongly convex dorsally, while those which succeed are depressed and broader. The segments along the middle and posterior regions of the body are more elongated than the anterior ones, but the latter are not so short and crowded as in *L. polybranchia*. The branchiæ commence on the third body-segment, as simple slender cirri, and become pectinate on the fifth; they occur on about thirty segments. The anterior ones are pectinate, with about six long, slender papillæ; farther back, on the eighth segment, they become much larger, in length being equal to about one-half the breadth of the body, and bear twenty or more long, slender, tapering papillæ. The head is short, thick, and slightly bilobed or emarginate in front. It bears five slender tapering antennæ, of which the median-dorsal and outer-lateral ones are much shorter than the superior-lateral pair. The latter, when turned back, reach to about the tenth body-segment; they are very long, slender, and delicately tapered. The median antenna, in the specimen examined, is about equal in length to the outer lateral, and is not more than one-eighth the length of the superior lat-

eral antennæ. (In the specimen described it may have been lost and reproduced.) The eyes are black, rather conspicuous, and situated between the bases of the lateral antennæ. The anterior part of the buccal segment is not much elongated on the dorsal side, or scarcely longer than the posterior half; its anterior dorsal margin is deeply concave behind the antennæ, but on the sides advances toward the anterior margin of the head so as to partially cover the eyes and sides of the head. The posterior portion of the buccal segment is about equal in length to the succeeding segments, it bears a pair of slender, tapering tentacular cirri, which extend forward to the front margin of the head and are about equal in length to the lateral antennæ, though somewhat more slender. The parapodia of the first segment are small and have a small, conical, tapering, dorsal cirrus and a ventral cirrus of the same form, but shorter and less acute at tip; the setigerous lobe is rudimentary. On the next two segments the dorsal cirrus becomes long, slender, and tapered to the tip, and the ventral cirrus is elongated, round, somewhat fusiform and subacute at tip. The setigerous lobe on the second segment is small and bears a cluster of setæ; it increases in size and number of setæ on the following segments. On the sixth and succeeding segments the ventral cirrus has the base thickened and swollen; this gradually increases in size, while the terminal portion diminishes in length and becomes reduced to a low, conical tubercle, but on the posterior segments it again becomes a small, round, tapered papilla. The caudal cirri are long, very slender, tapered to a fine tip, about equal in length to the twelve last segments.

Station 865, 1880, and 943, 1881, in 65 and 157 fathoms.

This species is named in honor of Mr. J. E. Benedict, of the United States Fish Commission.

Leodice polybranchia Verrill.

Verrill, Proc. U. S. Nat. Mus., vol. iii, p. 357, 1880.
Verrill, Trans. Conn. Acad., vol. iv, p. 323, pl. 14, figs. 7, *7a*, *7b*.
Verrill, Report U. S. Fish Com. for 1883, [p. 22], pl. 41, fig. 180, *a*, *b*, 1885.

Body large, much elongated, composed of very numerous short segments, much thickened and rounded anteriorly; somewhat depressed and tapered in the middle and posterior regions. The anterior segments are much shorter and closer than those behind the middle. The dorsal surface of the anterior portion of the body is convex; the ventral surface usually has a shallow median groove. The body is broadest a short distance back from the head, gradually increasing in breadth from the buccal segment to the tenth to twelfth body-segments.

The head is short, rather narrow, deeply emarginate or bilobed in front, and bears five slender, tapering antennæ, of which the three upper are nearly equal and about three or four times as long as the lateral ones. The two frontal lobes or palpi are broadly rounded in front, thick, and turned somewhat downward. The buccal segment bears on

its short posterior annulation a pair of slender, tapering tentacular cirri, which are about equal in length to the lateral antennæ, and when directed forward their tips extend beyond the bases of the superior antennæ. The eyes are small, not conspicuous, and situated between the bases of the two outer antennæ. The head in preserved specimens is often concealed as far as the eyes at the bases of the antennæ, by being retracted beneath the free anterior edge of the large buccal segment, which is about as long as the four succeeding segments. The branchiæ commence on the sixth body-segment and extend to near the posterior end of the body, only about five of the caudal segments being without them. The gills when best developed are pectinate, with about eight long, slender papillæ. The parapodia of the first four or five anterior segments bear a long, slender, tapering, dorsal cirrus; a much shorter, obtuse, papilliform ventral cirrus; and a small, short, round, setigerous lobe. On the sixth and succeeding segments the ventral cirrus becomes a low, rounded or oblong tubercle, surmounted by a minute papilla, but on the posterior segments the ventral cirrus again becomes an elongated, conical, obtuse papilla. The dorsal cirri decrease in length from the second segment backward, but those on the seven anterior segments are distinctly longer than those that succeed them. The setigerous lobe increases in size from the anterior segments backward. The setæ on the anterior segments are few and small, but increase in number and size on the succeeding segments. The caudal cirri are moderately long, slender, acute, in length somewhat exceeding the tentacular cirri.

Stations 865, 871, 872, in 65 to 115 fathoms, 1880; station 950, in 71 fathoms, 1881; stations 1092 and 1109, in 202 and 89 fathoms, 1882, and at many other stations in later years, in 60 to 258 fathoms.

Hyalinœcia artifex Verrill.

Verrill, Proc. U. S. Nat. Mus., vol. iii, p. 358, 1880.

Verrill, Trans. Conn. Acad., vol. iv, p. 323, pl. 14, figs. 6–6*d;* pl. 17, figs. 14, *a, b*, 14*a,* 1881.

Verrill, Bull. Mus. Comp. Zool., vol. xi, p. 45, pl. 6, figs. 1, *g, h, k, j, i*, 1883.

Verrill, Report U. S. Fish Com. [p. 22], pl. 41, figs. 178, *a, b*, 178*a*, 179, *a, b, c, d, e;* pl. 44, fig. 177, 1885.

Body much elongated, composed of very numerous segments, broad and strongly depressed, except near the anterior end, where the body becomes narrower and thicker to the buccal segment, which is nearly as high as broad. The anterior segments are much longer than those farther back, strongly convex above, and with a broad and deep ventral furrow in the preserved specimens. These segments are widest and somewhat swollen at the front edge, narrowing backward in the middle and posterior regions; the segments are short and closely crowded, less convex above, nearly flat, and with a shallow groove beneath; these segments have only a slight constriction between them on the dorsal and ventral surfaces, while those of the anterior region have a much

more marked constriction. The post-buccal segment is longer and somewhat broader than those which succeed it; its breadth on the ventral surface is more marked than on the dorsal, the sides are swollen and extend forward to the parapodia, which are very large and conspicuously directed forward and downward so as to have a somewhat claw-like appearance; the dorsal margin of this segment is nearly transverse, but often has a slight median lobe; the outline on the ventral side is deeply concave. The next segment and its appendages are also larger than those which follow, but not so conspicuously different as the post-buccal; its parapodia are large and project forward, but not so strongly as the preceding ones; dorsally it does not differ much from those which follow, but on the ventral side it is somewhat longer and is only partially crossed by the ventral groove. The next two or three segments show a transition to the ordinary segments of the anterior region, the parapodia becoming less prominent and less turned forward, while the ventral cirrus becomes gradually reduced in length. The buccal segment is narrower and shorter than the post-buccal, and bears no appendages.

The cephalic lobe is short, narrower than the buccal segment, and bears five long, slender, tapering antennæ, which are arranged nearly in a transverse line; of these the three upper are nearly equal in length, while the lateral ones are about one-third the length of the others; all have large, conspicuous, basal articles, which are crossed by about three conspicuous annulations. The two frontal antennæ are in the form of small, short, rounded, obtuse verrucæ, standing out close together from the anterior margin of the head. The palpi are more than twice as large as the frontal antennæ, and situated just below; they are short, thick, rounded verrucæ in contact at their bases, directed forward and downward in front of the mouth. No eyes are distinctly visible in preserved specimens, although there are irregular patches of black pigment around the bases of the antennæ. In the preserved specimens two hard, white, acute maxillary plates are usually protruded just below the wrinkled and papillose lower lip, which surrounds them on the lower side like a collar. The parapodia of the post-buccal segment are large, conical, with swollen bases turned forward and downward and strongly transversely wrinkled or annulated around the base; they bear a slender, tapering dorsal cirrus about the middle of the upper side, and a similar, somewhat shorter, ventral cirrus close to the base beneath; the setigerous lobe is large, swollen, obtuse, and bilobed at the end, the upper lobe being flat, obtuse, concave beneath, while the lower posterior lobe is in the form of a small conical papilla of equal length close to the tip; the setæ are amber-colored, usually about three in number, large, stout, spine-like, and curved somewhat downward toward the tip; part of these are usually broken or wanting. On the next segment the parapodia are decidedly smaller and less turned forward; the dorsal

cirrus is somewhat longer and rises nearer the base; the ventral cirrus is nearly as large, but not quite so long as the dorsal, and the setigerous lobe is bilabiate, with the two lips less unequal in size; the posterior one is flattened and a little longer and narrower than the anterior, which is obtusely rounded at the tip. The setæ are more slender, more numerous, less spine-like than in the preceding segments. The parapodia of the third segment are a little smaller than the second, with the dorsal and ventral cirri nearly the same, but the posterior lip of the setigerous lobe becomes decidedly longer, narrower and more tapered, considerably longer than the anterior lip, which is short, flat, and obtusely rounded at the end; the setæ form a fascicle of four or five, and are more slender and acute. The parapodia of the fourth segment differ from those of the third in having the ventral cirrus much reduced in length in the form of a short, somewhat compressed, obtuse papilla slightly separated from the base of the setigerous lobe; the length of the posterior lip of the setigerous lobe is also increased, while the anterior one is more reduced.

On the fifth segment the ventral cirrus becomes still shorter, broader, and more verruciform, while the posterior lip of the setigerous lobe becomes slender, tapering, and cirriform, but the anterior lip becomes more rudimentary. On the succeeding segments the vertral cirrus becomes more and more reduced in length and increased in transverse breadth, in the form of a broad, low wart or cushion, below the bases of the parapodia, which beyond about the twenty-fifth is decidedly broadest in a transverse direction. The branchiæ commence at about the twenty-eighth segment in the form of a long, slender, tapering cirrus arising from the base of the dorsal cirrus, which it at first equals or somewhat exceeds in size and length. Farther back the branchiæ increase in size and length, while the dorsal cirri gradually decrease, so that along the middle region of the body the branchia is long and slender, equal in length to about one-half the breadth of the body, while the dorsal cirrus is a small, slender, tapered papilla, not more than one-eighth as long. The caudal segment is small, narrow, rounded or truncate at the end, and bears two long, slender caudal cirri, nearly as long as the longest antennæ but much more slender.

The color of preserved specimens is light yellow, usually with a brilliant iridescence anteriorly, and usually with a dark brown median dorsal stripe consisting of two rows of spots, a pair to each segment, but the median stripe is not unfrequently absent, especially on the anterior segments.

Stations 869, 879, 880, 881, 894 in 192 to 365 fathoms, 1880. Also taken in great abundance at many stations in subsequent seasons by the Fish Hawk and Albatross, in 110 to 500 fathoms. Among others at stations 2170, 2175, 2178, 2200, in 148 to 452 fathoms, 1884, at all of which it was abundant.

Nothria conchyphila Verrill.

Verrill, Trans. Conn. Acad., vol. iv, pl. 23, fig. 4, 1881.
Verrill, Report U. S. Fish Com. for 1883, [p. 22], pl. 41, fig. 181, 1885.

Body elongated, depressed, narrow and slender, of nearly uniform width throughout the greater part of its length. The head is moderately large, short, nearly as broad as the buccal segment. The median and upper lateral antennæ are long, slender, gradually tapered, with a large basal portion composed of seven, eight, or more annulations. The outer lateral antennæ are similar in form, but are scarcely more than half as long as the upper lateral ones. The buccal segment is large, longer, but not so wide as the first body-segment; it is broadest in front and tapers backward to the suture, and bears near its front dorsal margin a pair of small, fusiform tenacular cirri, which scarcely reach forward to the bases of the antennæ. The first body-segment is larger than those that succeed it, broadest anteriorly, narrowed posteriorly to the suture; it bears large, prominent parapodia, which turn somewhat forward and downward. These bear rather long dorsal cirri, rising from beyond the middle of the dorsal side, and a similar but somewhat shorter, slender ventral cirrus, with a cirriform setigerous lobe and a small cluster of setæ between them. The two succeeding pairs of parapodia are similar in form and structure, but are less turned forward, and bear larger fascicles of setæ. Branchiæ commence on the fifth body-segment and have at first three or four divisions; farther back they increase in size and number of pinnæ.

Stations 865 to 867 in 64 to 65 fathoms, abundant, and at station 895 in 238 fathoms, 1880; also taken in great abundance at many other stations in subsequent seasons by the Fish Hawk and Albatross, in 65 to 350 fathoms. Especially abundant off Chesapeake Bay and Cape Hatteras in 60 to 100 fathoms.

Notophyllum Americanum Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 23, figs. 7, 7*a*.
Verrill, Report U. S. Fish Com. for 1883, pl. 40, fig. 184, 1885.

Body rather large, elongated, composed of numerous segments, somewhat narrowed toward the head, abruptly narrowed and obtuse at the posterior end. Head rather small, subtruncate posteriorly, somewhat narrowed and obtuse anteriorly, broadest across the eyes, which are large, situated near the posterior angles, and project somewhat beyond the margin of the head. Four frontal antennæ nearly equal, somewhat fusiform, tapered to the tip, in length about equal to the head, each with a dark green spot in the middle. Median antenna much longer than the frontal, similar in shape, and with a similar median spot; it arises from between the eyes. Tentacular cirri four on each side, the two anterior shorter, scarcely more than half the length of the two posterior, but about one-third longer than the median antenna. The two posterior tentacular cirri are rather large, stout, regularly tapered, and about four times the length of the median antenna. Behind the posterior

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dorsal border and at the base of the upper tentacular cirri there is, on each side, a cluster of small papillæ, about five in each cluster. Caudal cirri two, small, rather obtuse, papilliform, projecting but slightly beyond the posterior parapodia, and shorter and more obtuse than the frontal antennæ. The parapodia bear very large dorsal branchiæ, which are broadly rounded, imbricated, and almost completely cover the back; the anterior pair are smaller, narrower, and more ovate than those that succeed them. The posterior branchiæ are more crowded and more closely imbricated than the anterior ones, and entirely conceal the dorsal surface of the body. Color very dark green.

Off Martha's Vineyard, in 100 fathoms, 1881. U. S. Fish Commission steamer Fish Hawk.

Anaitis formosa Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 23, fig. 8.

Body moderately large, rather slender, tapered to both ends. Head moderately large, somewhat pentagonal in outline; it is broadest opposite the eyes, which are situated close to the lateral angles, a little behind the middle. From the lateral angles the head narrows rapidly to the anterior end, which is small and obtusely rounded; posteriorly the head narrows less, and the posterior border is subtruncated in the middle. Eyes rather large, wide apart, black. Frontal antennæ four, subequal, small, slender, tapered to acute tips; their length is less than the breadth of the head. Proboscis, as seen extended, is narrow, cylindrical, and covered with rather large, prominent, obtuse papillæ. Buccal segment is large, broader than the head, and extends forward on the sides of the head to the lateral angles. Tentacular cirri four on each side, similar in form, the two superior ones somewhat longer than the two inferior; they are all thickened a short distance above the base, and then taper gradually to the short acute tips. The longer ones are in length as long as the head and buccal segment together, and extend back to the fourth body-segment in alcoholic specimens. The branchiæ on the first few segments are rather small, ovate; farther back they gradually increase in size until at the eighth they become large, broad-ovate, with the ends well rounded, and conceal the parapodia and a considerable portion of the dorsal surface of the body. Color, pale green, crossed by two conspicuous bands of much darker green on the seventh and eighth body-segments.

Vineyard Sound, Massachusetts, in shallow water; also taken at the surface, August 1, 1881.

Anaitis picta Verrill sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 14, figs. 1, 1*a*, 1881.

Body of moderate size, rather slender, gradually narrowed anteriorly, broader and obtusely rounded at the posterior end. Head rounded

laterally, subtruncate posteriorly, broadest near the posterior end, somewhat narrowed to the anterior end, which is subtruncate and rather broad; the lateral and posterior angles are well-rounded. Frontal antennæ small, very slender, equal in length to scarcely more than half the breadth of the head. Eyes moderately large, situated near the lateral angles, at about the posterior third of the head. Buccal segment large, broader than the head, extending forward on the sides of the head beyond the eyes. Tentacular cirri unequal, the two inferior pairs much shorter than the two superior ones; all are thickened or somewhat swollen above the basal article, and then taper gradually to a slender, acuminate tip. The two inferior pairs are nearly as long as the head, the two superior ones about one-third longer; all have a well-defined basal article. The second superior pair evidently arise from the first body-segment. The caudal cirri are very small, scarcely projecting beyond the end of the body, and are of a short elliptical or oblong form, obtuse at the end. The branchiæ on the anterior segments are rather small, obovate, narrowest at the basal end, broadly rounded distally, each with a distinct dark green spot in the middle; farther back they gradually become much larger and broader; posteriorly they become broad-ovate, broadest near the basal end and narrowed distally. The setæ are very long and numerous, in large fascicles, which project far beyond the branchiæ and ends of the parapodia.

The ground-color of the body is pale green or greenish white; along the back are three rows of dark green spots, one row occupying the median line, with a transverse elliptical spot on each segment; the lateral rows are formed by a spot on the sides of each segment, just at the bases of the parapodia. Each branchia has also a dark green spot in the center, which gives the appearance of a dark-green line of spots when the branchiæ lie back in regular imbricated order. On the sixth, seventh, and eighth body-segments there is an appearance of a broad, transverse, interrupted band of dark green color, produced by an increase in the size of the median dorsal spots, which become so large as to coalesce more or less. When closely examined, however, this band can be separated into its constituent spots, separated by paler intervals.

Vineyard Sound, Mass., 1882, in shallow water.

This species is closely related to *A. speciosa*. It may be distinguished by the more slender body; the more heart-shaped head; the longer and narrower form of the branchiæ; and by the different coloration, especially in wanting the clearly-defined band on the seventh and eighth segments, seen in the latter.

Castalia cincinnata Verrill, sp. nov.

Body with about forty-six setigerous segments, thickest near the head, tapering back to the narrow, caudal segments. Dorsal surface very convex and prominent, with a median dorsal groove; lower side flat. Para-

podia elongated, prominent, directed rather downward; setæ numerous and long, pale yellow, with a slender terminal article. Head broader than long, truncate or slightly emarginate in front, with the angles prolonged in the form of stout, tapered tentacles, nearly as long as the breadth of the head; hind border narrower. Eyes four, dark-brown, reniform, two anterior twice larger and a little farther apart than the posterior, with a distinct, transparent front lens; the two pairs very little separated. Proboscis short, swollen, with a circle of about twelve small, conical papillæ at the edge, as expanded, and a small, raised, lateral lobe at the base, on each side. Frontal antennæ close to the lateral on each side, much more slender, of about the same length; three pairs of slender tentacular cirri on each side, crowded together, the three upper ones with short, basal joints, very long, thread-like, much longer than the dorsal cirri; these stand above the line of the parapodia. The two first pairs of dorsal cirri are similar in size and length, and also have very large basal joints, more prominent than those of the following ones, which are slender and moderately long. All the cirri are transversely annulated, but not beaded. Near the tip of the parapodia, above, is a small conical cirrus, and another occurs on the lower side at the tip.

Ventral cirrus small, slender, not very long, situated beyond the middle of the parapodia. The papillæ on the proboscis are about four dorsal and four on each side, apparently with none on the ventral side, where there is a groove.

Total length in alcohol 18^{mm}.

Station 871, in 115 fathoms, 1880; station 925, in 229 fathoms, 1881; station 2021, in 179 fathoms, 1883.

Syllis spongiphila Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 24, figs. 10, 10*a*, 1881.
Verrill, Report U. S. Fish Com. for 1883, pl. 42, fig. 183, *a*, 1885.

A large, stout species, composed of numerous segments, which are separated by well-marked constrictions. Head short, broad, nearly semicircular in outline, with the middle of the posterior dorsal edge a little produced backwards in the form of a very obtuse, rounded lobe. Eyes four, the anterior larger and farther apart, situated near the outer bases of the lateral antennæ; the posterior pair are situated behind the bases of the same antennæ. The palpi are large, prominent, projecting forward in the form of broad, ovate, flattened lobes, which in length considerably exceed the length of the head; their outer-posterior edges are broadly rounded, projecting somewhat beyond the margin of the head, while the anterior ends are narrowed, but obtusely rounded at the tips. The odd median antenna is rather long, rising from the posterior margin of the head, and, like the lateral antennæ, it is regularly beaded. The lateral antennæ are about two-thirds as long as the median and somewhat more slender. The tentacular cirri are nearly equal and

similar in size, length, and beading to the median antenna. The dorsal cirri on the first body-segment are stouter and nearly twice as long as the median antenna, which they resemble in form and the character of the beading. On the succeeding segments the dorsal cirri are similar in structure, size, and appearance, but some are considerably shorter than others, with some indications of alternation in length, which, however, does not appear to be regular; but the cirri of the second segment appear to be one-third shorter than those of the first segment. The ventral cirri are short, tapered, and scarcely exceed the setigerous lobe. The setæ are numerous, not very long, nor very slender, with a small acute-triangular terminal article, which is minutely bidentate at tip. Pharynx large, crooked, extending through about seven body-segments, armed near the anterior end by a single small, sharp, conical tooth. Color yellowish white. Length about 25^{mm}.

Off Martha's Vineyard to Cape Hatteras, common and often very abundant among sponges and hydroids in 65 to 125 fathoms.

Ophioglycera, gen. nov.

Head large, ovate, obtuse, depressed, divided into two parts by a constriction in front of the eyes, the posterior portion with a raised middle area. Antennæ none. Eyes minute. Proboscis long, armed with a ring of denticles, and a large jaw on each side having several teeth, unequal in size; and with a circle of soft papillæ around the orifice. Body large and stout, consisting of very numerous well-defined segments, and divided into two well-marked regions; the anterior region is shorter and more rounded than the posterior, and consists of shorter segments, with very different parapodia, those of the anterior region having prominent, elongated cirri, above and below, with a small, intermediate, three-parted, inferior setigerous lobe, bearing a small fascicle of setæ; upper setigerous lobe rudimentary. The posterior parapodia are much larger, and divided into two flattened, bilobed branches, separated by a rounded space; the lower ramus bears a ventral cirrus, and each bears a large fascicle of setæ.

Ophioglycera gigantea Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 15, figs. 1, 1*a*, 1*b*; pl. 25, fig. 1; 1881.
Verrill, Report U. S. Fish Com. for 1883, pl. 42, figs. 185, 185*a*, 1885.

Body large, very long, stout, anterior region subterete, narrower than the posterior, which is broad and depressed. Head, in the living specimens, ovate, longer than broad, narrowed, but obtusely rounded in front, smooth, but with two slightly-marked longitudinal grooves, which terminate in two small pits at the posterior dorsal border; four small specks, which are probably rudimentary eyes, form a quadrangle on the posterior segment of the head. In an alcoholic specimen, especially when the proboscis is protruded, the head-lobe becomes much shorter and subtriangular, with the tip obtuse. The buccal segment is similar to the six succeeding ones.

The first seven pairs of parapodia are smaller than the following ones, but are two-branched; the lower branch is divided into distinct, terminal lobes, and bears a ventral cirrus and a small fascicle of setæ; the upper branch is swollen, papilliform, and turned upward. The succeeding segments of the anterior region increase successively in size, and bear larger parapodia. These parapodia have a long, ligulate ventral cirrus, longer than the setigerous lobe; the setigerous portion bears two groups of setæ, and is divided into three tapering lobes, two of which terminate the anterior lip and are smaller than the posterior lip. At about the fifty-eighth segment the small, acute, papilliform, superior lobe appears; this contains a small fascicle of short setæ. Arising from the superior side of the parapodia, close to the base, there is an elongated, flattened, tapering, acute, ligulate process, with the tip directed upward; this is similar to the ventral cirrus in size and length. Farther back, beyond the seventy-fifth segment, the upper dorsal ligula develops a lobe or auricle on its upper side, near the base, which becomes more prominent further back, where the terminal portion of the ligula becomes reduced in size. At about the ninetieth segment there is an abrupt change in the form and size of the body and parapodia; beyond this point the segments are much broader and more depressed; the median dorsal field is smooth and nearly continuous, and nearly similar to that of the anterior region, each segment being marked by two distinct transverse lines; the lateral fields above the parapodia are broad and deeply incised between the segments.

The ventral surface has, as in the anterior region, a broad and deep, concave groove, bordered on each side by a raised, rounded ridge; the lateral portion is much more prominent than on the anterior region. The parapodia of this region are prominently two-branched, the ventral branch being much larger, and separated from the dorsal branch by a rather wide, rounded interval, appearing like a furrow along the sides; the dorsal branch consists of a swollen, conical, setigerous lobe, bearing a broad cluster of very slender setæ arising somewhat in two groups, and a broad, swollen, dorsal ligula, with a distinct lobe at the base on the dorsal side, and a prominent, papilliform tip. The inferior branch has a large, prominent setigerous lobe, divided at the end into two distinct, tapering, acute, anterior lips, and a broad, flattened, spatulate, posterior lip, terminating in a small, central, acute papilla; between these lips is a broad, fan-shaped fascicle of slender, capillary setæ, much longer than those of the dorsal branch. The ventral ligula is as long as the setigerous lobe and arises from about the middle of the lower edge; it is swollen at the base, flattened toward the end, somewhat falcate, tapering to near the end, which is obliquely subtruncate and ends in a small papilliform tip. Close to the base of the parapodia and at some distance from the ligula there is a very small papilliform organ. Towards the posterior end of the body this becomes larger and more prominent. The posterior parapodia have the dorsal branch nearly as

large as the ventral, with the setigerous lobe and the superior ligula nearly equal in size and both lanceolate; the ventral ligula is shorter, more flattened, and lanceolate in form, with a tapering tip. The dorsal fascicle of setæ becomes very small and inconspicuous, posteriorly. The parapodia on the segments close to the end become much smaller. The last segment is small, rounded, papilliform, and has a small, central orifice; in the living specimens it bore two small caudal cirri.

The proboscis is large and clavate when exserted, with the surface nearly smooth, but showing minute granules under a lens. Around the orifice there is a circle of a larger, soft, blunt papillæ; within these is a ring of minute, black denticles, mostly two-lobed at the tip, and a much larger jaw on each side, terminating in five sharp, recurved, unequal denticles. These jaws are surrounded at the base by a special circle of soft papillæ.

Color of the specimens, in alcohol, dark brownish olive, becoming somewhat glaucous blue on the segments, and with a somewhat lustrous surface. The lower surface is more yellowish, with the median groove and transverse lines, corresponding to the segments and intervals between them, glaucous blue. In life the surface has a brilliant metallic luster.

The first and much the largest specimen was taken in the evening in the harbor of Newport, R. I., swimming at the surface, by Master Willie Gray, August, 1880. This specimen was 20 inches in length and nearly one-half an inch in greatest breadth.

Polydora tubifex Verrill, sp. nov.

Tentacles very long and slender, of nearly uniform breadth throughout, but slightly tapered, the edges crenulated. Head with the central lobe narrow, prominent, in the usual state emarginate or bilobed anteriorly, with the lobes short and rounded; posteriorly extending back on the first segment to a blunt point. Eyes four, nearly in a transverse line, the outer ones a little farther forward, often with an additional small black spot on each side. Lateral lobes of the head (or buccal segment) large, thick, and swollen, laterally and beneath. Four anterior segments with short appendages and papilliform dorsal cirri, and with long capillary setæ; fifth segment with a small upper fascicle of slender, capillary setæ and a lower one of rather small and slender spines; sixth segment with short appendages; on the seventh, the branchiæ commence as short, flat, blunt, rounded organs, strongly ciliated; farther back they become longer, ligulate, scarcely tapered, or sometimes even broadest distally, in length equal to about half the breadth of the body; they extend to near the tail. Caudal appendage small, consisting of four short, blunt lobes; the lower ones slightly prolonged ventrally.

Color pale yellow or salmon, with bright red vessels; on the anterior five or six segments there are often, on each side, greenish black, linear, transverse marks on the anterior side of the parapodia or between the segments. Antennæ, pale greenish.

Length, 24^{mm} to 36^{mm}; diameter about 1^{mm}.

This species constructs long, slender, straight, round tubes of fine sand and mud, 48 to 70^{mm} long; 1^{mm} in diameter, found on a bottom of sandy mud, in from 1 to 5 fathoms, Wood's Holl, Mass., September 6, 1884.

This species is easily distinguished from all others known on our shores by having the four eyes nearly in a transverse row. The larvæ in various stages of growth were taken at the surface, in the evening, in the harbor of Wood's Holl, during August and September.

Ammochares artifex Verrill, sp. nov.

Head appendages partly forked and partly bifurcate, white, the two dorsal longest, bifurcate, with about six divisions, which are blunt, the length about one-half the diameter of the body; the upper-lateral pair are shorter, but also bifurcate, with four small, short, blunt branches; below these are two shorter, smaller, lateral pairs, only once forked. Head obliquely truncate in front, with the mouth terminal. Two first setigerous segments are coalescent with the head, short, with an upper fascicle of slender acute setæ, but no lower ones; on the third setigerous segment there is a long and broad band of uncini, and a group of slender setæ above. Several segments are long and round, not distinctly separated by a sulcus; several anteanal segments are short and indistinct, three, four, or more bearing setæ; anal segment simple, with minute papillæ.

Color anteriorly whitish, the head and buccal segment reddish, with a pale ring behind the tentacles; toward the posterior end the segments are pale flesh-color, translucent, showing the red vessels, and an orange, internal, convoluted organ.

This species constructs a long, slender, flexible tube, covered with small imbricated grains of sand, which are attached only by their inner ends, so as to be freely movable, one upon another, when the worm is in motion.

Off Cape Cod, at station 322, in 67 fathoms, 1879.

Lepræa abyssicola Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 20, figs. 3, *3a;* pl. 27, fig. 2.
Verrill, Report U. S. Fish Com. for 1883, pl. 43, figs. 187, 187*a*, *b*, 1885.

Body large, elongated, composed of numerous segments, tapering gradually to the posterior end. Many of the segments of the posterior region are destitute of capillary setæ. Cephalic cirri numerous, long and slender. Cephalic collar rather broad, with a row of numerous small black ocelli arranged in many rows just behind the anterior margin. Branchiæ in three pairs, the anterior ones much the largest, the posterior ones the smallést. The anterior pair have a rather long stem giving off five or six branches from the posterior side, the first originating at a little distance from the base, leaving a naked stem. The branches again divide and subdivide in a somewhat arborescent man-

ner, the ultimate branchlets being small and not very numerous. The second and third pairs of branchiæ are similar in form, but have fewer branches, all of which arise from the posterior side of the stem. Capillary setæ commence on the third branchiferous segment, but a pair of small papillæ corresponding to the upper parapodia occur on the second branchiferous segment; they continue on seventeen segments. The tori commence on the second branchiferous segment, but distinct rows of uncini first occur in those of the first segment behind the branchiæ. The uncini are in long rows and have a rather narrow, somewhat crescent-shaped base, with three terminal hooks, of which the innermost is much the largest, long, sharp, rather narrow, somewhat incurved, while the outermost is very small and acute, closely pressed against the base of the intermediate one.

Color, when fresh, dark red or reddish brown.

Length of the body usually from 60 to 75^{mm}. Some are larger. Station 874, in 85 fathoms, 1880, and in many other stations in subsequent seasons, in 50 to 130 fathoms.

Sabella picta Verrill, sp. nov.

Verrill, Trans. Conn. Acad., vol. iv, pl. 20, figs. 5, 5*a*, 5*b*; pl. 21, fig. 7.
Verrill, Report U. S. Fish Com. for 1883, pl. 42, figs. 188, 188*a*, 1885.

Body elongated, moderately stout, 50 to 60^{mm} in length, with a well-marked ventral groove on the eight anterior segments. Collar well-developed, with a plain, somewhat revolute margin, emarginate beneath; posterior end abruptly tapered, with numerous short segments, the last simple. Branchiæ numerous, long, slender, forming a beautiful wreath in expansion, united nearly half their length by a web, with a small, spatulate, naked tip. Cirri numerous, close, long, slender, longest on the distal half; ocelli none. The spatulate setæ are rather stout, with the tips considerably expanded and bluntly rounded. The uncinate setæ are somewhat recurved, a little swollen distally, with the tips strongly bent and beak-shaped, and with about four small denticles at the curvature. Caudal segment acute-conical. Color of the body greenish, specked with bright red, most so posteriorly and anteriorly, on the collar the red predominates. Branchiæ transparent greenish white, with transverse spots of flake-white and bright red; bases light red.

Off Martha's Vineyard in 30 to 120 fathoms; off Point Judith, R. I., at station 784, in 20 fathoms, 1880.

ECHINODERMATA.

Synapta brychia Verrill, sp. nov.

Verrill, Report U. S. Fish Com. for 1883, p. 37, 1885.

A large species, with a strong, thick, opaque purplish brown skin, as preserved in alcohol. The strong longitudinal muscles are lighter colored. The skin contains rather large, scattered, ovate plates, easily

visible to the naked eye. They are perforated by numerous (seventy to eighty or more) small rounded openings, and have a central eminence, composed of several slender processes. Each plate bears a large anchor, its length equal to that of the plate. The shaft of the anchor is round and smooth, narrowed next the expanded end, which is surmounted by several rough or lacerate denticles; the flukes are long, sharp, smooth, strongly recurved, more than a third as long as the shaft. Many of the anchors project from the skin, and are large enough to be visible to the naked eye. Length, in alcohol, 160^{mm}; diameter, 10^{mm}.

Station 2111, in 938 fathoms, off Cape Hatteras, 1883.

Ophiomitra spinea Verrill.

Verrill, Amer. Journ. Sci., xxix, p. 153, 1885.
Verrill, Report U. S. Fish Com. for 1883, p. 42, 1885.

A large species resembling *O. valida.* Arms five, long and stout; disk five-lobed, indented between the arms; radial shields moderately large, irregularly ovate, with a small notch in the broad outer end; their inner ends are separated by a wedge of small scales, but the outer ends are in contact, or nearly so; disk-scales rather small, unequal, bearing small, low, conical spinules or granules; a few granules on the outer end of radial shields and bases of the arms. Arm-spines, eight or nine at base of arms, long, slender, acute, sharply thorny, arising from prominent side-plates; the middle spines are the largest and roughest; the rows do not meet above at base of arms. Mouth-shields rhombic, with incurved lateral margins; the inner angle acute, the outer one obtuse or rounded; side mouth-shields thickened, crescent-shaped; tentacle-scale rather large, those at base of arm wide, flat, and obtuse; farther out lanceolate and rather acute. Mouth-papillæ numerous, unequal, rather irregular and crowded at the outer mouth-angles, where they form two or more rows; in the largest example there are eighteen to twenty, or more, in each angle; in the smaller one about twelve; they are mostly rather slender, spiniform, or papilliform, the outermost one wider and more flattened. The larger specimen has the disk 14^{mm} in diameter; the smaller one, 11^{mm}.

Station 2035 in 2,038 fathoms, 1883, two specimens.

Ophiacantha fraterna Verrill, sp. nov.

Verrill, Report U. S. Fish Com. for 1883, p. 43, 1885.

Disk rounded, rather swollen, with ten slightly raised radial ridges made by the radial shields, which have the outer ends small, a little prominent and naked. The surface of the disk is covered with very small, short, obtuse, rough spinules, terminated by several minute sharp thorns; usually mixed with these there are many small, rather rough, conical granules, of about the same size. Arm-spines at base of arms about eight, longest on the second and third joints beyond the disk, but the rows are not closely approximated dorsally. The upper spines are long, very slender, acute, and but slightly roughened; the middle ones are a little thorny; the lower ones comparatively short. Tentacle-

scale flattened, small, tapered, subacute. Ventral arm-plates narrow, about as long as broad, strongly convex on the outer margin, and with a distinct angle on the inner. Mouth-shields small, transversely cross-shaped, with a small outer lobe extending a little on the interbrachial spaces, and with a small, very obtuse angle on the inner margin, the side-lobes much larger and more prominent. Side mouth-shields rather wide, somewhat crescent-shaped, strongly curved. Mouth-papillæ about three on each side, besides a larger one below the teeth; they are rather long, spiniform, and acute, the outer one not differing from the rest. Color in alcohol dull brownish yellow, usually with darker brown blotches on the arms and disk. Diameter of disk, usually 9 to 12^{mm}.

This species has hitherto been confounded with *O. bidentata*, which it resembles. It differs in the smaller size and different character of its disk-spinules, in the rougher spines, smaller and more acute tentacle-scales, and in the sharp, spiniform, outer mouth-papillæ. The mouth-shields have an outer lobe extending somewhat on the interbrachial spaces, though less so than in *O. millespina* and several other species.

Taken at numerous stations by the Fish Hawk and Albatross in 908 to 1,608 fathoms. Common.

Ophiacantha varispina Verrill, sp. nov.

Verrill, Report U. S. Fish Com. for 1883, p. 43, 1885.

Disk slightly five-lobed, covered on the central part with small, elongated, tapered, acute, rough spines, which are gradually replaced toward the margins by shorter and stouter, very rough, obtuse stumps, surmounted by a group of sharp, rough spinules; radial shields slightly exposed at the prominent outer end. Arms slender; the spines about eight, somewhat rough, glassy; the upper ones long, slender, acute, the rows nearly meeting on the second joint beyond the disk; the lower ones are shorter and very slender; tentacle-scale flat, subspatulate, broadly rounded at the end. Ventral arm-plates near base of arms not much broader than long, rather pentagonal, the outer edge curved, or subtruncate in the middle, the inner edge nearly straight or slightly angulated centrally. Mouth-shields strongly four-lobed, the inner angle acute, with concave sides, the lateral lobes prominent, subacute, the outer lobe smaller, obtuse, extending somewhat on the interbrachial area; side mouth-shields wide, not very long, somewhat crescent-shaped, the outer margin convexly arched to fit the concave sides of the mouth-shield. Mouth-papillæ mostly flat and broad, lanceolate or obtuse, three or four on each side besides the infradental; a slender, smaller one often stands out of line, back of the outermost, which is flatter and more obtuse than the others. Color yellowish brown, with darker blotches on disk and arms. Diameter of disk, 9^{mm}; length of arms, 35^{mm}.

Peculiar in the mixture of sharp spines and obtuse thorny stumps on the disk. General appearance much as in *O. bidentata*.

Off Nova Scotia, station 2069, in 101 fathoms.

Ophiacantha granulifera Verrill.

Verrill, Amer. Journ. Sci., xxix, p. 153, 1885.
Verrill, Report U. S. Fish Com. for 1883, p. 44, 1885.

Disk five-lobed, covered with small, rounded and conical, slightly rough granules; radial shields form ten rather prominent ridges, naked only at the rounded and prominent outer end; interbrachial spaces beneath scaly, with few granules. Arms rather broad. Arm-spines eight to nine at base of arms, the rows not approximating dorsally; the upper ones are long, very slender, acute, slightly roughened; the middle ones are stouter and distinctly thorny; the lower ones much shorter; tentacle-scale small, lanceolate, subacute, except on the two first joints, where they are obtuse and flattened, and sometimes two together; side arm-plates broadly united ventrally; ventral arm-plates unusually broad and short, especially on the second to seventh joints, where they are transversely oblong, the outer margin nearly straight or slightly emarginate, the inner edge with a slight median angle; farther out they become longer, narrower, and somewhat trapezoidal. Mouth-shields small, somewhat cruciform, with a small outer lobe, an obtuse inner angle, and acute lateral lobes. Side mouth-shields larger, broad, strongly curved, thickened, and minutely granulose. Mouth-papillæ all spiniform, three or four on each side, besides a larger one below the teeth. Color light brownish yellow, with darker blotches on the arms. Diameter of disk, 9^{mm} to 11^{mm}.

Easily distinguished by the short, wide ventral arm-plates and the small, close granules on the disk.

Off Nova Scotia, in 101 to 200 fathoms.

Ophiacantha enopla Verrill.

Verrill Amer. Journ. Sci., xxix, p. 153, 1885.
Verrill, Report U. S. Fish Com. for 1883, p. 44, 1885.

Easily distinguished by having numerous mouth-papillæ, the outer ones forming a crowded group at the end of the mouth-angles. The disk is covered with small, obtuse or rounded, granule-like stumps, slightly spinulated at the end. The arm-spines are long and slender, glassy, seven or eight near the base of the arms, forming a nearly continuous band on the dorsal side. Color in life, orange.

Off Martha's Vineyard, stations 1122, 1124, 2046, etc., in 351 to 640 fathoms, 1882, 1883, 1884.

Ophiacantha aculeata Verrill.

Verrill, Amer. Journ. Sci., xxix, p. 153, 1885.
Verrill, Report U. S. Fish Com., p. 45, 1885.

A large species, with five unusually long, gradually tapering arms. Disk rounded and swollen, throughout evenly covered with small, slender, elongated spinules, having rough sides and terminated by four to six slender, rough, divergent points. These disk-spinules are less crowded, smaller, longer, and more slender than in *O. bidentata*. End

of radial shields not exposed. Arm-spines very long, slender, nearly smooth, eight or nine at base of arms, those next to the edge of disk decidedly longer and forming an almost continuous band above. Tentacle-scales rather wide, but with acute tips at base of arms, rapidly becoming smaller and acute-lanceolate farther out. Mouth-shields rather small, rounded externally, and not extending much on the interbrachial spaces, obtuse-angled on the inner side. Jaws broader and more obtuse than in most species. Mouth-papillæ rather slender, usually three or four on each side of a jaw, besides the median one; the outer one is largest, broad and flat at base, rapidly narrowed toward the acute end; the next two are more slender, spiniform, and acute; sometimes an additional smaller one stands out of line, behind those in the regular row. Color, light orange or buff. Diameter of disk of a large example, 17^{mm}; length of arms, 110^{mm}.

Off Martha's Vineyard, stations 2034 and 2105, in 1,346 to 1,395 fathoms, 1883. On *Brisinga elegans* V.

Ophiacantha crassidens Verrill.

Verrill, Amer. Journ. Sci., February, 1885.
Verrill, Report U. S. Fish Com. for 1883, p. 45, 1885.

This large species is easily distinguished by its disk, covered with small, conical, acute spines, and by the remarkably large, rough, and thick mouth-papillæ, which are crowded. The arm-spines are rather short and blunt. The color is dark brown in alcohol.

Station 2115, in 843 fathoms, off Cape Hatteras, 1883 (No. 9370).

Ophiacantha gracilis Verrill, sp. nov.

Verrill, Report U. S. Fish Com. for 1883, p. 46, 1885.

A small, delicate species, with long, slender, attenuated arms. Disk round and full, covered with relatively large, easily visible scales, each of which bears a rather large and high columnar spinule, a little enlarged at the summit and terminated by five, six or more, slender, sharp, divergent points. Arm-spines, along most of the length of the arm, four or five, short for the genus, being about half as long as an arm-joint; the small upper one is tapered; the lower ones are stouter, rough, blunt, and hooked at the end; the lowest is largest and most hooked; on the two joints next to the disk the five spines are much longer, very slender, tapered, acute; the two upper ones twice as long as an arm-joint. Tentacle-scale small, spiniform; mouth-papillæ few, about three on each side of a jaw, besides a larger, odd, terminal one; the lateral ones are small, spiniform; the two outer ones stand a little back from the slit, like tentacle-papillæ; mouth-shields small, narrow, rounded without; acute-angular within; side-shields large, angular; ventral arm-plates widely separated, elongated, rounded on the outer edge; the inner end with an angular median point. Diameter of disk, 3.5^{mm}; length of arms, about 22^{mm}. Probably young, but very unlike the young of any of our other species.

Mostly off Nova Scotia, in 220 to 858 fathoms, on Gorgonians.

Ophiacantha bidentata (Retz.) Ljung.; Lyman (*pars*) "Challenger" Ophiuroidea.

Ophiacantha spinulosa (M. and Tr.) Lyman, Illus. Catalogue Mus. Comp. Zoology, p. 93, figs. 6, 7.

The form here intended is the same as that described and figured by Lyman, Lütken, Duncan and Sladen, and others as *O. spinulosa*, from northern waters. Lyman's deep-water specimens, in part at least, belong to *O. fraterna*.

Common northward, in moderate depths, from Massachusetts Bay to Greenland.

Ophiolebes Acanellæ Verrill.

Verrill, Amer. Journ. Sci., vol. xxix, p. 153, February, 1885.
Verrill, Report U. S. Fish Com. for 1883, p. 46, 1885.

Disk rounded, swollen, covered above and below with rather large, globular or capitate stumps, minutely spinulose at the end. Arms short. Arm-spines at base of arms, six or seven, short, obtuse, rough, with small spinules; the four lower are shorter and stouter than the upper ones, with a blunt or clavate, rough, thorny tip; the upper ones are more cylindrical, but mostly blunt, shorter than the breadth of the arm-joint; the lower groups of three or four spines extend nearly to the mouth-angles. Mouth-papillæ, three or four on each side, small, nearly equal, rounded, obtuse. Diameter of disk, 6^{mm}.

Off Nova Scotia, in 91 to 122 fathoms. Station 2071, on *Paramuricea borealis*, in 113 fathoms.

Amphiura Otteri Ljungmann (?); Lyman.

In this species the disk is covered with small scales, above and below; the radial shields are elongated, wedge-shaped, with a narrow group of scales between their divergent and tapered inner ends. The arms are very long and rather slender, flattened, usually with about six spines, toward the base, but in large specimens there may be as many as eight; they are moderately long, tapered, and, except the upper ones, mostly a little bent toward the end, with the tip slightly hooked. Two flat, blunt tentacle-scales, which are very small and indistinct in young specimens; a pair of stout mouth-papillæ at the end of each jaw, and a smaller spiniform one on each side, a little farther back; a stout, erect, spiniform tentacle-papilla at the outer end of the mouth-slit, on each side.

Off Martha's Vineyard in 182, to 1,608 fathoms (487 to 1,608 fathoms, 1883). Not uncommon.

Amphiura fragilis Verrill, sp. nov.

Verrill, Report U. S. Fish Com. for 1883, p. 47, 1885.

Disk, five-lobed, covered above with small, delicate scales, naked beneath; radial shields, pear-seed-shaped, slightly divergent, the inner ends separated by a narrow row of scales. Arms long and slender;

arm-spines, four or five near the disk, usually four along the middle and three toward the tip of the arms; they are subequal in length, the upper one a little longer and more enlarged toward the base, the tips obtuse and minutely roughened or spinulose on one side. Tentacle-scale absent or rudimentary. Mouth-shields small, rounded; side mouth-shields rather broad. Mouth-papillæ, four to each angle; a pair of large, stout, blunt ones stand at the end of the jaw, and a much smaller, spiniform, acute one a little farther back on each side; there is also an acute spiniform, erect papilla outside of the mouth-tentacle, opposite the outer angle of the mouth-slits, as in *A. Otteri*. Ventral arm-plates, subquadrate, longer than broad, with the outer angles rounded and the inner ones truncated; farther out they become shorter and somewhat five-sided, with the outer margin rounded and the inner corners so much truncated as to form a median angle. Diameter of disk of an ordinary specimen, 5^{mm}; length of arms, about 30^{mm}. Resembles the young of *A. Otteri*, but differs in lacking tentacle-scales and in having the disk naked below, and in the arm-spines, which are not curved.

Off Martha's Vineyard, in 239 to 1,467 fathoms, 1883, 1884.

Ophioscolex quadrispinus Verrill, 1884.

Verrill, Report U. S. Fish Com. for 1883, p. 48, figs. 56, 56*a*, 56*b*, 1885.

Disk swollen; arms five, long, attenuated distally. The disk and base of arms are covered with a thick, soft skin, with close wrinkles or small rounded verrucæ above, becoming concentric and radial wrinkles beneath, but beyond the basal part of the arms becoming smoother and thinner, concealing the feebly developed arm-plates. Arm-spines four, or alternately three and four, near base of arms (three in young examples), nearly equal, rather stout, tapered; lower ones blunt; upper, acute in part, scarcely as long as the breadth of the arm. Tentacle-scale small, tapering, acute; teeth, six to eight or more, rather slender, acute, often in pairs; mouth-papillæ, small, slender, acute, unequal, eight to ten on a side of each angle, besides two or three larger ones outside of the second mouth-tentacle and one within the slit at the first mouth-tentacle; the outer papillæ in large specimens are crowded so as to form two or more rows. Large examples have the disk 14^{mm} in diameter; length of arms, 70^{mm}.

Off Martha's Vineyard to Nova Scotia, in 101 to 234 fathoms (101 fathoms, off Nova Scotia, 1883). Stations 1121 and 2069; also Gulf of Maine, station 38, in 112 fathoms, 1878. Rare.

Hemieuryale tenuispina Verrill. Report U. S. Fish Com. for 1883, p. 48, 1885.

Astronyx? tenuispina Verrill, Amer. Journ. Sci., vol. xxviii, p. 219, 1884.

The disk is covered with thin, roundish scales, visible when dried, without granules; radial shields prominent distally; arms with small scales above, and larger prominent ones along the sides; spines three,

the upper longest; tentacle-scales small, spiniform; mouth-shields small, rhombic; mouth-papillæ several, small, in a regular row.

Off Martha's Vineyard, in 1,362 to 2,033 fathoms, 1883. Locally abundant on *Scleroptilum gracile* V.

HYDROIDA.

Cladocarpus flexilis Verrill, sp. nov.

Verrill, Report U. S. Fish Com. [p. 35] for 1883, pl. 10, fig. 29, 1885.

Stem tall, slender, flexible, sparingly branched; branches with long, slender pinnæ; calicles narrow, elongated, closely appressed, separated by intervals equal to about half their length; margin prolonged dorsally into a small, acute denticle; dorsal surface but little convex, anterior half nearly parallel with the branch. The posterior median nematophore is rather large, situated close to the posterior end of the calicle, or a little behind it, with its opening oblique and directed upward and outward; the lateral nematophores are smaller, cup-shaped, and project forward but little beyond the margin of the calicle. Opposite each calicle there are five or six internal transverse divisions of the branch and about three in the intervals between the calicles. The gonothecæ are few, moderately large, ovate, borne on sparingly branched processes arising from the stem at the bases of the pinnules. Color, light yellowish horn-color. Height from 100^{mm} to 200^{mm}.

Very common in 70 to 125 fathoms, on hard spongy bottoms, off Martha's Vineyard to Cape Hatteras.

TUNICATA.

Culeolus Tanneri Verrill, sp. nov.

Verrill, Report U. S. Fish Com. for 1883, p. 27, pl. 31, figs. 144, 145, *a*, *b*, 1885.

Stem long, slender, somewhat decreasing in size from the base to the summit. Body irregularly pear-shaped, the lower end tapering to a conical form, where it joins the stem, while the stem itself can be seen extending upward about 15 to 20^{mm} along the dorsal margin, where it forms, for that distance, a rounded midrib, terminating in a prominence in one specimen and at a depression in another. The dorsal margin is nearly straight, but swells out a little in the middle, and is subcarinate, with a row of small scattered papillæ along the ridge. The distal end is large, rounded, swollen, and bordered on each side by a distinct keel, which is covered with several crowded rows of prominent, rough, though soft papillæ, which merge into a large, triangular patch of similar but larger papillæ, situated on the dorsal side near the distal end, where the dorsal carina meets the lateral ones; the papillæ in this cluster are large, stout, tapering to a point, and covered on all sides with minute, conical spinules. The lateral rows of papillæ extend back to about the middle of the body on the ventral side, where they meet, thus inclosing a large

ovate area, near the middle of which the large cloacal-opening is situated. This opening is bilabiate, each lip bordered with one or two rows of elongated, rough papillæ, like those of the lateral carinæ. The oral opening is very large, in expansion nearly round, the proximal side sometimes bending inward, leaving a sinus on either side of it; the margin is thickened and revolute, bordered by a row of small, tapering papillæ. The whole surface of the test is covered by minute, granule-like or conical elevations, which are rather close over the dorsal parts, less numerous beneath. Color, dull yellowish gray, the stem dark brown.

Length of the stem of one specimen, 155^{mm}; its diameter near the base, 2^{mm}; length of body, 70^{mm}; greatest diameter, 40^{mm}; diameter of mouth, 8^{mm}.

Station 2041, in 1,608 fathoms, 1883.

Oct. 3

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REPORT ON THE FLORA OF WESTERN AND SOUTHERN TEXAS.

By DR. V. HAVARD, U. S. A.

The observations and collections on which the following report is based were made at the several posts where I have been stationed since August, 1880, also, and chiefly, while on duty with the expeditions for the exploration of Western Texas, under the command of Maj. William K. Livermore, chief engineer officer, Department of Texas, in the summer and fall of 1881 and 1883. The specimens themselves will be presented to the National Museum.

The first part describes in a general way the vegetation of Western and Southern Texas. The various topographical features of the land are considered separately and their botanical physiognomy sketched as accurately as possible. It includes such meteorological notes as were deemed useful for the better understanding of the subject.

The second part is made up of economic notes on the plants known to have useful or baneful properties or to be of value to agriculture or industry.

My grateful acknowledgments are particularly due to Mr. Sereno Watson, of Cambridge, and Dr. George Vasey, of the Department of Agriculture, for their valuable assistance in the determination of species.

PART I.

GENERAL VIEW.

Austin, the capital of Texas, lies within the timbered agricultural section of the State. South and west of it, the mean annual temperature increases while the rainfall decreases so that a change of vegetation soon becomes perceptible. San Marcos and New Braunfels are still centers of prosperous farming districts; farther south the success of crops is not so assured. After crossing the Guadalupe the change of climate is marked and becomes more and more striking. The timber grows thinner on the prairies, seldom extending far from valleys or water-courses; broad plains are covered with Mezquit, so characteristic of a serene, rainless sky. West of the Colorado and San Antonio Rivers, and south of the latter, farming is only remunerative on bottom-lands of valleys; it ceases, practically, west of the headwaters of the San Saba, Llano, and Nueces, and south of the Frio, or is only possible in rare valleys with irrigation.

Dallas and Fort Worth stand in the midst of a fine agricultural

region. Thence, going westward on the Texas Pacific Railroad, no material change is noticed until the Brazos is passed when the arboreal vegetation becomes less luxuriant. The Cottonwood and American Elm, common hitherto, are now sparse, while the Mezquit begins to show itself. Groves of Live Oak, Red Oak and Juniper continue as far as Baird. Beyond this town, we pass out of the timbered and farming region of North-Central Texas and gradually enter what has been called the great Texano-Mexican Desert, a vast expanse of plains and prairies, scarred by arroyos, where streams are few and very far apart, and timber, if there be any, confined to water-courses and mountains. The epithet of desert has only reference to the scarcity of timber and water, which imparts a bald, barren aspect to the face of nature; shrubby and herbaceous vegetation fairly covers this immense zone which in many districts is admirably adapted to the raising of live stock. Even sandy, alkaline soils are seldom entirely destitute of grass or chaparral.

If we draw a line from the southeast corner of the Pan Handle, or from Fort Elliot, to the harbor of Corpus Christi, we shall divide Texas in two unequal parts. The eastern, comprising about two-fifths of the State, with rich alluvial soil, warm climate, and good rainfall, is an excellent agricultural and pastoral land. The larger western part, of cretaceous formation, consists mostly, as already mentioned, of treeless plains of various degrees of fertility and barrenness, from the best pastures to bare sand flats. Near the extreme west, from the New Mexican border to the Great Bend of the Rio Grande, are several large mountain systems where good timber and perennial waters are found.

I roughly estimate that, of the western plains beginning at the imaginary line drawn above, one-third is worthless owing to sterility of soil and absence of water. One-third, with good loamy land watered by living springs and running creeks, always affords excellent grazing. The capability of the other third to subsist herds and flocks depends entirely upon the rainfall, and, therefore, varies from year to year; thus the district which an explorer in a dry season finds a barren waste, may, the next year, with an increased and better distributed precipitation, be covered with good grass through which flow many ephemeral streamlets; hence the discrepancy of accounts as to the pastoral worth of Western Texas.

RAINFALL.

The rainfall of Western Texas is small and exceedingly variable as to time and quantity. It ranges from 10 to 33 inches. At San Antonio, the mean is 32.75; it decreases irregularly but steadily as we proceed westward to El Paso and the Colorado of the West, then increases slightly to the ocean. Although the rainfall is small in Western Texas, it is not as scant and hopeless as in the desert districts of Arizona and California.

All this is shown in the following table computed from the data of

five or more years, obtained, for the most part, from the office of the Chief Signal Officer, United States Army:

Locality.	Inches.
San Antonio	32.75
Fort Clark	29.37
Eagle Pass	26.06
McKavett	21.71
Stockton	15.91
El Paso	13.06
Tucson	10.83
Yuma	3.28
San Diego	9.97

It is in the western counties of Texas where the rain is least, viz., Tom Green, Crockett, Pecos, Presidio, El Paso, each larger than the State of Vermont, that are found the worst lands of the State. In these counties there are, outside of mountains, but two or three creeks permanently running, and only for 3 or 4 miles.

There is no well-defined rainy season in Western Texas; rain falls in fitful "spells" at any, and often the most inopportune, time, with long intervals of drought. Two or three months receive one-half of the yearly precipitation. It is the season of sudden rises and floods which, in a few hours, cause irreparable damages and again as promptly subside, drained away by timberless arroyos, so that but a comparatively small amount of moisture is retained in the earth and penetrates to the subsoil.

Three or four, or more, months of the year are entirely without rain, or only receive an insignificant amount. It is the season of dust storms and prairie fires; then springs dry up, streams stagnate or sink out of sight. Even the Rio Grande, above its main Mexican tributary, the Conchas, ceases to run, and in many places its bed becomes a sinuous avenue of glaring sand.

Generally speaking, there are two yearly waves of rainfall; the smaller from April to June, the larger from August to November. They shift more or less from year to year and vary also according to locality. At San Antonio, a large proportion of the rain falls during the winter and early spring.

TEMPERATURE.

Excluding the tropical southern half of Florida, the mean annual temperature of the Lower Rio Grande is the highest in the United States. Next to Key West (mean 77.5), Fort Ringgold has the unenviable distinction of being the hottest military post in the Union. Its mean annual temperature (data from the office of the Chief Signal Officer) is 73.4, about a degree higher than that of Fort Yuma (72.3), the hottest post west of the Rocky Mountains. Next to Ringgold, come in order:

Laredo, 72.6; Brownsville, 72.42 (U. S. Hospital observations); Eagle Pass, 70.57; all of which places are on the Rio Grande.

West and north of a line passing through Eagle Pass and San Antonio, the annual mean falls below 70; it is sensibly lower than that of military posts lying at higher latitudes in Arizona and Southern California. It decreases slightly going west, as in the following table, in which no correction is made for latitude.

Locality.	Temperature.
Galveston	69.92
San Antonio	69.24
Fort Clark	69.07
McKavett	65.56
Stockton	64.97
El Paso	63.67

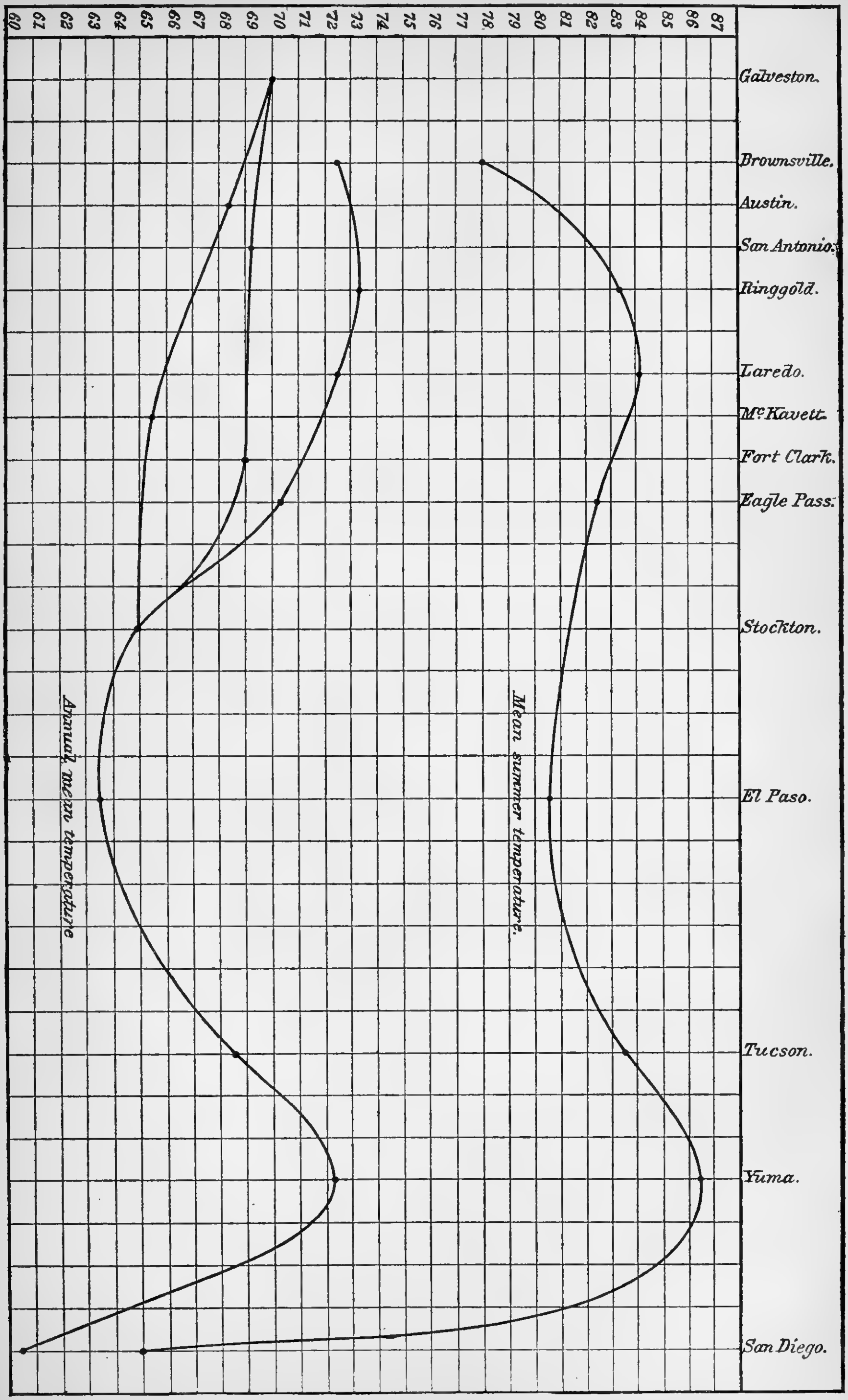
Fort Davis, lying in a mountain region, has a lower mean (61.84) as well as a higher rainfall (23.48) than would be expected from its comparative longitude.

The summer means (from May to September inclusive) of the several places noticed above do not always correspond with their annual means, a fact of considerable importance in the appreciation of local temperature. Ranked in the order of their summer means, Fort Yuma stands first (86°.26); Laredo, second (84.10); Fort Ringgold, third (83.64); Key West, fourth (82.86); Eagle Pass, fifth (82.46). The summer mean of El Paso is 80.76, showing that the estival temperature, on going westward towards the continental divide, does not decrease in the same ratio as the annual mean, and, therefore, that the greater fall of the latter is due to the colder winter.

A thermal line, drawn so as to represent by its altitude the varying mean annual temperature of the Mexican Boundary, would describe the following curves: From Brownsville, a rise to Ringgold, its highest apex; thence a gradual, slow fall to El Paso; a second and less rise to Fort Yuma, and another and much more abrupt depression to San Diego, Cal., its lowest point. It is interesting to notice that the peaks of this line, Ringgold and Yuma, are at about the same distance from the ocean, and that the great inland depression at El Paso is near its center.

The line of summer temperature, as already seen, would not be quite parallel with the above. From Brownsville it would rise and reach the summit of its first convexity at Laredo, thence descend by an almost imperceptible incline to El Paso, rise to its apex at Fort Yuma and fall to its lowest point at San Diego, Cal.

In both of these lines, the great and sudden depression from Yuma to the shore of the Pacific at San Diego, a distance of less than 200 miles, is very remarkable.



Thermal lines showing the mean summer temperature of the Mexican boundary; also the mean annual temperature of the same and other places. No allowance made for latitude or altitude.

VALLEYS.

In all valleys, where there is any arboreal vegetation at all, are found Mezquit and Hackberry of various dimensions. The other timber of valleys and the peculiarities of their flora will be noticed under the heading of their respective streams. In this place I shall only consider those general features which belong to all or most of them.

In the water of many creeks float the leaves of *Nuphar advena* (Yellow Pond-Lily); *Hydrocotyle interrupta*, *umbellata* and *prolifera* (Water Pennyworts); *Cabomba Caroliniana*; several species of *Potamogeton; Jussiæa repens*, from San Antonio eastward and northward.

Commonly growing in water, but more or less erect, are: *Nasturtium officinale* (Water-Cress), widely introduced; *Sagittaria variabilis* and *lancifolia* (Arrow-heads); *Samolus Valerandi* and *ebracteatus* (Water Pimpernels); *Cicuta maculata* (Water Hemlock); *Berula angustifolia* (Water Parsnip); *Mimulus luteus* and *Jamesii* (Monkey-flowers); *Herpestis Monniera; Dianthera Americana; Ludwigia palustris* and *natans; Lythrum alatum.*

On the immediate shore, near the water's edge, are frequently seen: *Lobelia cardinalis* and *splendens* (Cardinal-flowers), *Erythræa calycosa*, *Eustoma Russellianum*, *Epilobium coloratum*, *Œnothera biennis* and *Jamesii* (Evening Primroses), *Polygonum acre* and *hydropiperoides* (Knotweeds), *Marsilia vestita* and *macropoda*, *Ammania auriculata*, *Valeriannella stenocarpa*, *Erigeron Philadelphicus*, the last three hardly extending west of San Antonio, and the following grasses: *Arundo Donax* (Cane-Grass), *Phragmites communis* (Wild Broom-Corn), *Panicum virgatum* and *crus-galli*, *Zizania miliacea* (Indian Rice), *Uniola latifolia* (Spike-Grass), *Andropogon macrurus*, *Agrostis verticillata*, *Brizopyrum spicatum.*

Of shrubs we find—

On river shores or the dry bed of water-courses, commonly: *Cephalanthus occidentalis* (Button-bush), one of the most widespread of shrubs; *Baccharis angustifolia* and *cærulescens* (Groundsel-shrubs), *Pluchea borealis* (Arrow-wood), *Hymenoclea monogyra*, *Aster spinosus;* less frequently: *Ilex decidua* (Holly), east of Devil's River; *Cercis reniformis* (Western Red-bud), *Cornus Drummondii* (Texas Dogwood), east of Devil's River; *Rhamnus Carolinianus* (Alder-Buckthorn), east of Devil's River; *Karwinskia Humboldtiana*, west of Devil's River; *Amorpha fruticosa* (False Indigo), *Rubus trivialis* (Low Blackberry).

In dry mountain arroyos: *Unguadia speciosa* (Mexican Buckeye), *Leucæna retusa*, *Chilopsis saligna* (Desert Willow), *Juglans rupestris* (Nogal), the latter often of arboreal size.

In the shade of rocks along water-courses, west of Devil's River, are frequently seen two handsome shrubs, *Fallugia paradoxa* with feathery fruit, and *Tecoma stans* with golden, bell-shaped flowers.

Valleys are generally well covered with shrubbery, sometimes thin and scattered, as on the Upper Pecos, or dense, as on the Lower Rio Grande where it forms an impenetrable chaparral. This shrubby vegetation consists of:

Prosopis juliflora (Mezquit) and *pubescens* (Screw-Bean).
Zizyphus obtusifolius (Lote-bush).
Condalia obovata (Capul or Blue-Wood), *Mexicana* and *spathulata*.
Kœberlinia spinosa (Junco).
Acacia Farnesiana (Huisache), *flexicaulis* (Ebony), *filicina*, *Wrightii*, *Rœmeriana*, *Emoryana*.
Mimosa biuncifera (Uña de Gato), *borealis*, *Lindheimeri*.
Bumelia lycioides, *lanuginosa*, *spinosa*.
Parkinsonia aculeata (Retama).
Ptelea trifoliata (Shrubby Trefoil).
Lantana macropoda and *Camara*.
Lippia lycioides.
Lycium Berlandieri, *puberulum*, *Carolinianum*.
Sophora secundiflora (Frijolillo) and *affinis* (east of the Nueces).
Porliera angustifolia (Guayacan).
Celtis pallida (Granjeño).
Colubrina Texensis.

Many vines climb over trees and shrubs:

Rhus Toxicodendron (Poison Ivy).
Smilax tamnoides (Fiddle-shaped Greenbrier).
Cocculus Carolinus and *diversifolius*.
Maximowiczia Lindheimeri, with handsome, pendent, scarlet berries.
Philibertia cynanchoides, blossoming profusely all summer.
Roulinia unifaria.
Vitis candicans, *riparia*, *rupestris*, *æstivalis*, all edible Grapes growing thriftily and bearing excellent fruit.
Vitis incisa, *indivisa*, *bipinnata*, wild Grapes with pretty foliage but unpalatable berries.
Ipomœa sagittata, *pandurata*, *coccinea* (var. *hederifolia*), *Mexicana*, *sinuata*, *trifida* (Morning Glories).
Clematis Pitcheri and *Drummondii* (Virgin's Bower).
Passiflora fœtida, *tenuiloba*, *affinis*, *incarnata* (Passion Flowers).
Ampelopsis quinquefolia (Virginian Creeper).
Mekania scandens (Climbing Hemp-Weed).
Anredera scandens (Texas Madeira Vine).

Of the many herbs growing on valley bottoms, the most common and conspicuous are:

Callirrhoë involucrata, *digitata*, *pedata* (Purple Mallows).
Sida hederacea, *lepidota*, *physocalyx*.
Sphæralcea angustifolia.
Hoffmanseggia stricta.

Allionia incarnata.
Nyctaginia capitata.
Solanum elæagnifolium, nigrum, triquetrum, heterodoxum, rostratum, Torreyi.
Datura meteloides.
Petunia parviflora.
Chamæsaracha Coronopus.
Physalis lobata, hederæfolia (and var. *puberula*), *mollis* (var. *cinerascens*).
Salvia farinacea, lanceolata, Texana.
Monarda citriodora and *punctata.*
Tetraclea Coulteri.
Teucrium Canadense and *Cubense.*
Lippia nodiflora.
Verbena bipinnatifida, ciliata, bracteosa.
Lepidium intermedium and *alyssoides.*
Arabis Ludoviciana.
Draba cuneifolia.
Nasturtium obtusum.
Vesicaria Gordoni.
Cucurbita perennis.
Martynia proboscidea, fragrans, altheæfolia.
Euphorbia albomarginata, serpens, petaloidea, hypericifolia, dentata, heterophylla, marginata, maculata, glyptosperma.
Tragia nepetæfolia.
Acalypha hederacea.
Polygonum camporum, amphibium, Pennsylvanicum, incarnatum, aviculare.
Rumex hymenosepalus and *Berlandieri.*
Heliotropium Curassavicum.
Portulaca oleracea, retusa, lanceolata.
Sesuvium Portulacastrum.
Œnothera speciosa, pinnatifida, sinuata.
Gaura parviflora and *Drummondii.*
Asclepiodora decumbens.
Convolvulus incanus.
Phacelia Popei.
Nama hispidum.
Nemophila phacelioides.
Ruellia tuberosa.
Antirrhinum maurandioides.
Tribulus maximus and *grandiflorus.*
Corydalis aurea, var. *occidentalis.*
Argemone hispida.

And also the following Composites:

Helianthus lenticularis, petiolaris, ciliaris.

Gaillardia pulchella.
Lepachys columnaris, var. *pulcherrima.*
Gutierrezia Texana.
Helenium amphibolum.
Stephanomeria minor.
Verbesina encelioides.
Parthenium hysterophorus.
Heliomeris tenuifolia.

Characteristic of alkali flats or arid sandy bottoms, are:

Atriplex canescens (under several forms), *acanthocarpa, expansa.*
Suæda fruticosa and *depressa.*
Spirostachys occidentalis.
Acanthochiton Wrightii.
Cladothrix lanuginosa.
Varilla Texana.

SAN ANTONIO.

The flora of the valley of the San Antonio River, near its head where stands the town of San Antonio, being typical of that of the many valleys which drain the surrounding country, I shall, at the risk of repetition, describe it with some detail.

Many trees and shrubs leaf in March and, during the same month, many native flowers can be collected. In April the vegetation is in its prime; masses of luxuriant timber spread over the valley, thick shrubbery of various shades of green covers the uplands, and a sward of thin but nutritious grass carpets the ground. The pale green of the Mezquit-clad hills, contrasting with the somber foliage of the valley, is particularly striking. In May, plants begin to suffer from the hot and dry atmosphere. Before August, when summer rains usually begin, the scant grass has become parched, the shrubbery temporarily withered and the timber dimmed with dust. The first showers, however, quicken everything back to life. The winter temperature seldom falling below 20°, many ornamental shrubs prosper in gardens, and hardy rosebushes blossom all winter.

The homely but useful Mezquit (*Prosopis juliflora*), here as everywhere in South and Western Texas, is predominant; it is mostly a shrub, sometimes a stunted tree, and covers the slopes and many of the tablelands. Mixed with it are the hardly less common Lote-bush (*Zizyphus obtusifolius*) and Brasil or Blue Wood (*Condalia obovata*), two Rhamnaceous shrubs growing together and similar in appearance. To the same order belong also *Rhamnus Carolinianus*, a tall shrub in shady places, and *Colubrinia Texensis*, a low bush on higher ground near the head of the river.

Perhaps the tree most characteristic of San Antonio, and the pride of its inhabitants, is the Huisache (*Acacia Farnesiana*) which thrives everywhere in the valley, filling the air, in March and April, with the

delicate perfume of its capitate, yellow flowers. Pretty also are the shrubby *Acacia amentacea* and *Rœmeriana*, growing on gravelly hills.

The other ligneous Leguminosæ deserving mention are: The Frijolillo (*Sophora secundiflora*), a dark green shrub, on rocky grounds, with thick bunches of rank violet flowers early in the spring, and poisonous scarlet beans in summer; *Sophora affinis*, a small tree with green bark, loosely-clustered flowers (in March) and beaded pod; the Retama (*Parkinsonia aculeata*), an elegant ornamental tree more common on the Lower Rio Grande; *Cæsalpinia pulcherrima*, a bush with gorgeous orange flowers, common in gardens, introduced from Mexico; the Honey Locust (*Gleditschia triacanthos*), mostly cultivated.

Largest and most conspicuous of trees along the river is the lordly Pecan (*Carya olivæformis*), attaining here an enormous size, and the Cottonwood (*Populus monilifera*). Less common are Black Walnut (*Juglans nigra*), Bald Cypress (*Taxodium distichum*), Black Willow (*Salix nigra*), Green Ash (*Fraxinus viridis*, var., *Berlandieriana*).

Of the Urticaceæ there are several members: The common Hackberry (*Celtis occidentalis*), a rather handsome tree 1 to 2 feet in diameter, affecting several forms; the Thorny Hackberry or Granjeno of the Mexicans (*Celtis pallida* of Torrey), a stiff shrub bearing insipid yellow berries; the Red Mulberry (*Morus rubra*), growing everywhere and yielding luscious fruit; the Wild Mulberry (*Morus microphylla*), along the river; the Paper Mulberry (*Broussonetia papyrifera*), common in yards; the Water Elm (*Ulmus crassifolia*), a middle-sized tree along streams, and the only Elm seen about San Antonio; the Osage Orange (*Maclura aurantiaca*).

The Live Oak (*Quercus virens*), a large tree, forms the main feature of the arboreal vegetation on the higher grounds of the valley. Another Oak, smaller and less common, a form of Red Oak, is *Quercus rubra*, var. *Texana.* Post Oak (*Quercus stellata*) is also found on surrounding hills.

Of the Maple Family, the Box-Elder (*Negundo aceroides*), a small tree near the water, is the only representative. To a closely allied order belongs the Wild China-tree or Soapberry (*Sapindus marginatus*). The naturalized China-tree (*Melia azedarach*), on account of its hardiness and rapid growth, is a favorite shade tree.

Of the Rose Family, the only notable arborescent members are a species of Hawthorn (*Cratægus subvillosa*) and a Plum (*Prunus Americana*, var. *mollis*). Of the Rutaceæ, two shrubs are common: the Hop-tree (*Ptelea trifoliata*) along the river, and the Prickly Ash (*Xanthoxylum Clava-Herculis*) on hill-sides.

Other shrubs deserving mention are: The Trefoil Barberry (*Berberis trifoliata*), low, evergreen bush with glaucous, spiny leaves, yellow blossoms, and red, palatable berries; the well known Texas Persimmon (*Diospyros Texana*); the thorny *Bumelia lanuginosa;* a small Holly (*Ilex decidua*); a Dogwood (*Cornus Drummondii*); the pretty *Lippia lycioides*

bearing many slender racemes of exquisitely fragrant white flowers; *Forestiera pubescens*, *Vitis bipinnata*, *Sambucus Canadensis.*

Of vines, we have the Poison Ivy (*Rhus Toxicodendron*) very common and of luxuriant growth; the Texas Virgin's Bower (*Clematis Drummondii*), a pretty climber with long-feathered fruit; the Virginian Creeper (*Ampelopsis quinquefolia*) and several Grapes, viz.: *Vitis candicans* and *æstivalis* which yield scant but good fruit; *Vitis incisa* and *indivisa*, neat, hardy climbers but with useless berries.

Of the herbs of San Antonio, only the most characteristic can find place here.

The earliest, blossoming in February, are:

Allium striatum.
Anemone Caroliniana.
Arabis Ludoviciana.
Draba cuneifolia.
Linaria Canadensis.
Verbena bipinnatifida and *ciliata.*
Oxalis stricta.

In March, blossom the following:

Scutellaria Drummondii.
Vesicaria Gordoni.
Nemophila phacelioides.
Astragalus leptocarpus.
Gaura Drummondii.
Corydalis aurea, var. *occidentalis.*
Pinaropappus roseus.
Gaillardia simplex.
Lindheimeria Texana.
Veronica peregrina.
Œnothera triloba and *speciosa.*
Sisyrinchium Bermudiana.
Cooperia pedunculata.
Nemastylis geminiflora, slopes of reservoir, very showy.
Lupinus subcarnosus (Texas Lupine), covering fertile slopes with a carpet of purple blue.
Delphinium azureum (Azure Larkspur), here anomalously white-flowered.
Phlox Rœmeriana, small but showy, mixing abundantly its pink flowers with the two preceding.
Callirrhoë pedata (Purple Mallow), elegant and showy.
Gilia incisa.

Later in the season we find:

Gelasine Texana.?
Desmanthus acuminatus and *depressus*, grassy plots.
Neptunia pubescens, grassy plots.
Schrankia angustata, gardens.

Psoralea rhombifolia, Mezquit woods.
Vicia Ludoviciana, valley.
Medicago maculata, valley.
Indigofera leptosepala, sandy hillsides.
Sesbania macrocarpa, rare.
Cassia Lindheimeriana and *occidentalis*.
Malvaviscus Drummondii (Wild Fuchsia), common.
Malvastrum Wrightii and *tricuspidatum*.
Abutilon Wrightii and *Texense*.
Sida diffusa and *physocalyx*, yards.
Pentstemon Cobæa, elegant and showy, rare.
Castilleia indivisa, low Mezquit woods.
Maurandia Wislizeni, high Mezquit woods.
Teucrium Canadense.
Hedeoma acinoides and *Drummondii* (Pennyroyal), the former common in the valley, the latter abundant on hills.
Stachys agraria, valley.
Salvia farinacea, *ballotæflora*, *Texana*, *coccinea* (Sages), common.
Scutellaria versicolor, woods.
Monarda citriodora (Horsemint), abundant.
Brazoria scutellarioides, very pretty, in low places.
Bifora Americana.
Chærophyllum procumbens.
Daucus pusillus, var. *scaber*.
Polytænia Nuttallii.
Eryngium Wrightii ?, very showy late in summer.
Vesicaria argyrea, about the reservoir.
Streptanthus platycarpus ?.
Stellaria media and *prostrata*, valley.
Silene antirrhina, Government Hill.
Menodora heterophylla, common.
Specularia perfoliata, *biflora*, *leptocarpa*, *Lindheimeri*.
Asclepias longicornu.
Asclepiodora viridis.
Gonolobus reticulatus and *biflorus*.
Œnothera tetraptera and *serrulata* (Evening Primroses).
Linum multicaule and *Berlandieri*, both showy Flaxes.
Siphonoglossa Pilosella, common.
Ruellia tuberosa, very common late in summer.
Dianthera parviflora.
Oxybaphus nyctagineus.
Tradescantia Virginica.
Tinantia anomala, shady woods.
Sisyrinchium geniculatum and *anceps*.
Passiflora incarnata and *affinis* (Passion-Flowers).
Lithospermum Matamorense, shady woods.

Onosmodium Bejariense, shady woods.
Echinospermum Redowskii, var. *cupulatum*.
Evolvulus sericeus, very common throughout summer.
Convolvulus hermannioides.
Dichondra repens, roadsides.
Ipomœa trifida.
Nama Jamaicense, shade of fences.
Geranium Carolinianum, valley.
Euphorbia marginata, common and showy.
Geum album, river shore.
Yucca rupicola, very elegant; in rocky woods.
Nicotiana repanda (Wild Tobacco), common.
Solanum nigrum, *triquetrum*, *elæagnifolium*, *rostratum*, abundant.
Mirabilis longiflora, rare.
Bowlesia lobata, shade of fences.
Bouchetia erecta, Mezquit woods.
Spigelia Lindheimeri, Mezquit woods.

Humble but very elegant are two members of the Amaryllis Family, new crops of which appear after every summer shower, the white-flowered *Cooperia Drummondii* and the golden-petaled *Habranthus Texanus*.

The most common Composites, mostly homely weeds, are:

Verbesina encelioides and *Virginica*.
Ambrosia trifida.
Franseria tenuifolia, var. *tripinnatifida*.
Xanthium Strumarium.
Hymenopappus artemisiæfolius.
Gaillardia pulchella.
Helianthus lenticularis.
Parthenium Hysterophorus.
Lepachys columnaris, var. *pulcherrima*.

The last two, particularly, choke the lanes and vacant grounds of the town.

Of grasses we find—

In pastures:

Buchloe dactyloides (Buffalo or Mezquit Grass).
Bouteloua oligostachya, *hirsuta*, *Texana* (Gramas).
Aristida purpurea, var.? *longiseta* (Triple-awned Grass).
Stipa Neesiana.
Andropogon saccharoides and *scoparius* (Beard-Grasses).

Along the river:

Panicum Crus-Galli, var. *longisetum* (Panic-Grass).
Uniola latifolia (Spike-Grass).
Arundo Donax (Cane-Grass).
Zizania miliacea (Wild Rice).

In yards and gardens:

Cynodon dactylon (Bermuda Grass), introduced.
Panicum fuscum and *Texanum* (Panic-Grasses).
Hordeum pusillum (Wild Barley).
Leptochloa mucronata.
Paspalum distichum.
Eriochloa sericea.
Melica diffusa.
Digitaria sanguinalis (Finger-Grass).
Eragrostis oxylepis.
Setaria glauca (Bristly Fox-tail).
Festuca tenella.
Lepturus paniculatus.
Cenchrus tribuloides (Bur-Grass).
Bromus unioloides (Johnson-Grass).

VALLEYS EAST OF THE PECOS.

Most of the trees noticed on the San Antonio River reappear in other valleys east of the Pecos.

The Medina is well timbered with Pecan and Water Elm (*Ulmus crassifolia*); more sparsely with Cottonwood, Sycamore (*Platanus occidentalis*) and Bald Cypress, all large, useful trees. On higher grounds are groves of fine Live Oak whose short trunk measures from 2 to 4 feet in diameter.

The Hondo, Seco, and Sabinal (Cypress Creek) are poorly wooded; the Frio, only fairly so in scattered clumps.

The Nueces River, although dry in many places, is well timbered from the heads of its forks to its mouth. On its forks thrive the Chestnut Oak (*Quercus Muhlenbergii*), 3 to 4 feet in diameter, a smaller Oak with pale foliage (*Q. Durandii*), the Texas Red Oak (*Q. rubra*, var. *Texana*), the Soapberry (*Sapindus marginatus*), the Wild Mulberry (*Morus microphylla*) and the Black Willow. On its lower part are groves of Cottonwood and Texas Green Ash (*Fraxinus viridis*, var. *Berlandieriana*).

The country between Uvalde and Eagle Pass is drained by several creeks, viz.: Turkey, Chuparosa, Live Oak, Comanche, and Penitencia, all converging into Lake Espantosa. They are mostly dry, but their courses are well marked by fringes of Live Oak and Water Elm, together with Hackberry, Green Ash, Retama (*Parkinsonia aculeata*) and Black Willow.

Las Moras Creek takes its name from the scattered Mulberry trees (*Morus microphylla*) growing on its banks. Groves of Pecan, Live Oak, and Water Elm, with the usual Hackberry and Soapberry, are found near its head at Fort Clark.

The Pinto and Sycamore are thinly wooded all along their immediate margins. The San Felipe is fairly timbered near its mouth, but much of its course is bare.

The San Pedro, or Devil's River, is a large stream draining a hilly, grassy district, interesting alike to botanist, sportsman, and stockman. More or less timber is found all along its course, consisting of Pecan, Sycamore, Mulberry, Hackberry, Soapberry, and Willow, with shrubbery of Persimmon, Granjeño, Mezquit, and Frijolillo. In the vicinity of old Fort Hudson are groves of Live Oak. Between the bridge of the Southern Pacific Railroad and the old crossing, a distance of 3 miles, I observed four species of Grapes: *Vitis æstivalis*, *riparia*, *rupestris* and *candicans*, with intermediate forms, all growing luxuriantly.

Below Eagle Pass, the Rio Grande receives no tributary on the Texas side. Many arroyos drain the vast plains stretching from the Nueces and the Olmos Rivers to the boundary line, and several retain more or less rainwater, but there is no permanent running stream emptying into the Rio Grande from Eagle Pass to Brownsville.

Many streams, some becoming important rivers, take their origin along the eastern edge of the Staked Plains. I shall review them briefly as they appear within our limits.

THE CONCHO.

The Concho and its tributaries run through undulating, grassy plains. From Fort Concho we can trace their course for several miles by Pecan trees of luxuriant growth; they are also fringed in places with Live Oak, American Elm (*Ulmus Americana*), more sparsely with Cottonwood and everywhere with Hackberry. On the Main Concho the timber, thick below, becomes scant a few miles above Fort Concho, but scattered clumps extend as far as Camp Charlotte. On the North Concho there is good timber, restricted to the banks, as far as Sterling Creek. A small wild Plum (*Prunus rivularis*) with red, palatable fruit, is common on the Concho and Colorado. Dense thickets of Mezquit cover many of the surrounding high table-lands.

The most common Grasses in the Concho Basin and northward are, *Buchloe dactyloides* (Buffalo-Grass), *Aristida purpurea*, *Bouteloua oligostachya* (Common Grama), and *Hilaria mutica*, all, but specially the first and third, of excellent quality. The first two are commonly called Mezquit-Grass.

Decking the prairie on all sides, are the cherry-red *Callirrhoë pedata*, the Prairie Lily (*Cooperia Drummondii*), and the ubiquitous *Verbena bipinnatifida*, *Monarda citriodora*, *Salvia farinacea*.

THE COLORADO.

At Austin, the capital of Texas, the picturesque banks of the Colorado are well timbered with Pecan, Cottonwood, Sycamore, Cypress, several species of Elm and of Oak. The latter are: *Quercus virens* (Live Oak), *Q. rubra* (Red Oak), *Q. nigra* (Black Jack), *Q. macrocarpa* (Bur Oak), *Q. stellata* (Post Oak), *Q. palustris*. The White-heart Hickory

(*Carya tomentosa*) is also found in the vicinity, and Hackberry, Soapberry and Red Cedar are common.

Immediately above Austin the timber remains good. Beyond the San Saba it gradually decreases, and, after passing the mouth of the Concho, one sees only the American Elm and, in less quantity, Hackberry, Soapberry, and Willow. Still further up, at Colorado City, where the Texas Pacific Railroad crosses it, no timber is visible on the naked banks and the river has dwindled to a salt brook, often dry.

Two of the upper tributaries of the Colorado have permanent water, some wood, and run through good grazing districts: Tobacco Creek, fringed with Hackberry and Willow, and Champlin Creek. On the latter I noted two or three Cottonwood; Black Willow (*Salix nigra*) attaining a foot in diameter and the dominant tree; Hackberry and Soapberry; a small Plum (*Prunus rivularis*) and two shrubby Oaks, *Quercus grisea*, and var. *brevifolia* of *Q. undulata*, the latter 10 to 12 feet high. Large Mezquit woods cover many of the surrounding plains and afford excellent fuel and fence rails, but no building timber.

The San Saba and Llano Rivers, large western affluents of the Colorado, are fairly well timbered, and flow through fertile valleys, while good grass covers the surrounding plains. The prevalent trees along these streams are: Pecan, Cottonwood, Willow, Chestnut Oak (*Quercus Muhlenbergii*), Live Oak (*Q. virens*), a small Post Oak (*Q. Durandii*), American Elm and Mulberry (*Morus microphylla*). On the uplands the Red Cedar (*Juniperus occidentalis* var. *conjungens*) and the ordinary Post Oak (*Quercus stellata*) are conspicuous in places.

THE BRAZOS.

The Clear Fork of the Brazos runs through a good farming region. Its banks are covered with Pecan, Cottonwood, Live Oak, American Elm, Hackberry, Willow, and Mesquite. The last four trees or shrubs, with a few stray Pecan, extend into the southern branches of the Fork as far as Abilene and the range of high hills forming the watershed between the waters of the Brazos and those of the Colorado.

Above the mouth of the Clear Fork, the Brazos dries up in many places; the timber grows scarce and often disappears. Its several branches, shallow, sluggish and salt creeks, stretch westward through broken, naked plains and gypsiferous bluffs. Despite the barren aspect of the country the grass is very good in many districts, where thrive large herds of cattle.

On approaching the Staked Plains, water is purer, more plentiful, and the grass more nutritious and abundant. Small groves of Cottonwood are seen in sheltered cañons, notably in Cañon Blanco.

THE RED RIVER.

The many heads of the Red River, within the Pan Handle, afford an ample supply of excellent and permanent water, and meander through

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a very fine grazing region. Several of them are shaded with Cottonwood. Farther down the Red River is often dry, the timber scant or absent, and the grass very poor on the sandy plains.

Pease River and the Big Wichita run through arid, treeless plains; occasional clumps of Hackberry and Willow, and stray Cottonwood, are found in side cañons. Near its mouth the Big Wichita is well timbered.

THE PECOS.

The Pecos is not a wooded stream. Near its mouth, where its swift, muddy, and saline waters run through a deep, rocky valley, are clumps of Texas Green Ash (*Fraxinus viridis*, var. *Berlandieriana*), Willows (*Salix nigra* and *longifolia*) and Hackberry. Common here are the beautifully penninerved shrub, *Karwinskia Humboldtiana*, and the evergreen Guayacan (*Porliera angustifolia*) reaching an altitude of 15 feet. In a side cañon I noted other arborescent shrubs, *Quercus undulata*, var. *pungens*, *Fraxinus Greggii*, *Forestiera reticulata*. I failed to see the *Pistacia Mexicana*, a small tree found hereabout by Bigelow. In this vicinity were collected the following handsome and remarkable plants: *Pentstemon baccharifolius*, *Amoreuxia Wrightii*, and *Hibiscus cardiophyllus*.

On ascending the river the timber becomes very sparse; it increases slightly near the mouth of Independence and Live Oak Creeks and then disappears. Both of these creeks are good running streams, the former watering a grazing district noted for its excellence, the latter fringed with Live Oak and Cedar.

Above Live Oak Creek, the Pecos, a full-brimmed, muddy river, from 8 to 15 yards wide, meanders for several hundred miles through sandy, naked, broken plains, whereon neither topography nor vegetation betoken its course. The shrubbery on its banks consists of low Mezquit, Lote-bush (*Zizyphus*), Capul (*Condalia obovata*), Creosote-bush (*Larrea Mexicana*), Junco (*Kœberlinia spinosa*), Cenizo (*Atriplex canescens*) and *Lycium Carolinianum*. The Long-leaved Willow (*Salix longifolia*) grows in small clumps on the banks, often in company with a Grounsel-bush (*Baccharis angustifolia*) which spreads in many places its showy white panicles. Close to the water grow commonly: *Statice Limonium*, *Samolus ebracteatus*, *Eustoma Russellianum* and a giant form of *Aster divaricatus*.

The prevalent grass of the Pecos flats, and often the only kind, is *Sporobolus airoides*, with erect culm, 1 to 3 feet high, and loose, open panicle; it is distinctly salt to the taste and caused severe colic in most of the mules and horses of our party. Cattle readily eat it, and with

apparent immunity, which probably is obtained by all animals feeding on it long enough.

On bottoms, the most common Composites are *Conyza Coulteri* and *Bigelovia Wrightii.* Common also are *Helianthus lenticularis*, *Verbesina encelioides*, *Perezia Wrightii*, *Grindelia squarrosa*, and *Clappia suædæfolia*; and on alkali soils, the fleshy chenopods: *Suæda fruticosa* and *depressa*, *Spirostachys occidentalis.*

No peculiar vegetation distinguishes the Fall of the Pecos. The stream, rushing through a jungle of Cane-Grass (*Arundo Donax*), is parted by a rocky island and then tumbles about 20 feet over limestone bowlders, its muddy waters breaking into various shades of red and brown.

At Pope's Crossing, the Pecos is about 25 yards wide and from 1 to 3 feet deep, with hard, gravelly bottom. Its banks are still bare of timber, but in places shaded with Cane-Grass. The Cañagre (*Rumex hymenosepalus*) is quite abundant here, as at many other points along the river.

That part of the Pecos Basin from old Fort Lancaster up to Pope's Crossing, made up largely of barren flats, is about the worst; the grazing is fair enough on many of the adjoining slopes and hills, but nowhere sufficient for profitable cattle raising. Near the latter place the grass improves very much; on the plains north of it large herds of cattle roam and thrive, and settlements are forming.

It is worthy of notice that cattle, when accustomed to drink the saline water of the Pecos, prefer it to pure rain water.

On the fine rolling prairie near the mouth of Delaware Creek, the excellent grass consists of *Bouteloua oligostachya*, *hirsuta*, *racemosa*, *eriopoda*; *Aristida dispersa*; *Setaria caudata*; *Triodia acuminata*; *Pappophorum Wrightii.*

Two of the principal tributaries of the Pecos, Delaware Creek and Black River, are treeless except on their headwaters in the foothills of the Guadalupe Mountains; here are small groves of Cottonwood, Chestnut Oak (*Quercus Muhlenbergii*), a small Ash (*Fraxinus pistaciæfolia*), Hackberry, Soapberry, and Willow. They both run through an excellent grazing district. On the bluffs of Delaware Creek were collected a very large and remarkable form of *Boerhaavia leiosolena*, a new species of *Greggia* (*G. linearifolia*, Watson) and a *Nama* (*N. stenophyllum*, Gray) not before observed north of the Rio Grande.

VALLEYS WEST OF THE PECOS.

West of the Pecos the few running streams found outside of mountain districts are naked; they are: Comanche, Leon, Toyah Creeks, the Alamos, San Francisco, and Maravillas. On the forks of the last two may be seen a few clumps of Hackberry, Soapberry, and Willow; scattered Cottonwood occur near the head of the Maravillas.

COMANCHE CREEK.

Comanche Creek springs from the foot of the limestone bank on which stands Fort Stockton. It is a large, clear, rapid stream, strongly impregnated with alkaline salts; it runs 3 or 4 miles and then sinks. The country roundabout, a vast expanse of gravelly sand, is dreary in the extreme. There is not even a bush on the banks of the creek. Near the water's edge I noticed a handsome form of *Aspicarpa hyssopifolia;* also *Ludwigia palustris*, *Ipomœa sagittata*, *Samolus ebracteatus*, and such sea-shore plants as *Statice Limonium* and *Brizopyrum spicatum*.

On the gravelly mesa around the post are some of the usual herbs of the region—*Verbena bipinnatifida*, *Baileya multiradiata*, *Riddellia tagetina*, *Heliotropium Greggii*, *Melampodium cinereum*.

MOUNTAIN STREAMS.

The water-courses which drain the mountains are generally well timbered. On the Limpio, the most important stream between the Pecos and El Paso, stand groves of Cottonwood, scattered clumps of Red Oak and Emory's Oak, Hackberry, and Willow. Near its heads are forests of Pine. In the picturesque Wild Rose Pass the *Rosa Arkansana* is common; still more so are the feathery *Fallugia paradoxa* and the economic Cañagre.

The Cibolo, running on the east side of the Chenate Mountains, is densely wooded. Cottonwood (*Populus Fremonti*) 4 and 5 feet in diameter, and Texas Green Ash, 40 and 50 feet high with trunk 1 to 2 feet in diameter, are characteristically prominent. The other trees are Hackberry, Soapberry, Nogal (*Juglans rupestris*), Wild Mulberry (*Morus microphylla*), and Willows (*Salix longifolia* and *nigra*). Over these trees the Arroyo Grape (*Vitis riparia*) climbs luxuriantly, forming dense walls and bowers which yield, in the fall, small but very palatable bunches of fruit. South of the mountains and long before reaching the Rio Grande, the Cibolo is dry and timberless.

West of the Chenate Mountains runs Capote Creek, a small stream shaded from the fall to its mouth with Cottonwood, Texas Green Ash, and Willows. The neighboring bluffs are covered with excellent grass, principally *Bouteloua* and *Cathestechum*. I collected, at the fall, a new shrub, *Sageretia Wrightii*, Watson; and, thereabout, the following rare and interesting plants: *Elytraria tridendata*, *Sedum Wrightii*, *Desmodium spirale*, *Hibiscus Coulteri*, *Boerhaavia scandens*, *Pentstemon acuminatus*, *Aristalochia brevipes*.

The Chisos Mountains are drained by the Tornillo on the east and the Tarlinga on the west. The former, mostly dry, bears on its upper part a few small scattered Cottonwood, stunted Hackberry, Willows, and copses of shrubby Tornillo or Screw Bean (*Prosopis pubescens*). Its lower part is entirely naked. The Tarlinga contains more water and better timber; clumps of Cottonwood, beginning at Agua Fria, dot its

course through the cañon; the last 15 miles are naked except near a large spring, 2 miles from its mouth, where more Cottonwood are found.

The Bofecillos Mountains are drained by the Ternero on the west and the Grapevine on the east. The former is a dry arroyo for about 5 miles above its mouth, then becomes a running creek for 5 or 6 miles, with sparse Cottonwood, Texas Green Ash, Hackberry and Willow; this timber extends into several side cañons. In gravelly ravines near its head, the handsome shrub *Cassia Wislizeni* is common.

The Grapevine, one of the prettiest tributary cañons of the Rio Grande, contains a small stream which sinks and reappears in many places, and many clumps of Cottonwood, Green Ash and Willow. The *Vitis æstivalis?* grows thriftily over the trees, while the Maiden-hair Fern (*Adiantum Capillus-Veneris*) and Poison Ivy line the damp rocks. Here were collected two rare and showy grasses, *Cottea pappophoroides* and *Imperata arundinacea.*

Between the upper part of the Ternero and the Grapevine, including the northern portion of the Bofecillos Mountains, lies a vast grassy plateau which would be of great value as a grazing range were water more plentiful.

THE RIO GRANDE.

FROM EL PASO TO ITS MOUTH.

The valley, as it issues from the pass near which stands the town of El Paso, widens out into a broad plain covered with a forest of Cottonwood whose dense foliage contrasts strongly with the tawny gray of the bare slopes, the dark blue of the sharply outlined mountains and the pale azure of the sky.

The timber is confined to the river bottom and consists of Cottonwood* (*Populus Fremonti*, var. *Wislizeni?*), Willows and Sparse Ash (*Fraxinus pistaciæfolia, forma tomentosa* of Torrey). The Willows are two or three forms of *Salix nigra*, and *Salix amygdaloides* the larger and prevalent species.

The valley, below El Paso, varies in width from one to several miles and, wherever irrigated, produces fine crops of corn, Mexican wheat, onions, sweet potatoes, melons, cabbages, beans, alfalfa (*Medicago sativa*) and red pepper. It also produces excellent fruits, such as grapes, pear, and apricot. The Irish potato has not yet been successfully cultivated on the Rio Grande.

The Mezquit, as a low spreading shrub, remains prominent on high ground. Its congener, the Screw-Bean (*Prosopis pubescens*), or Tornillo of the Mexicans, growing in clusters 10 to 20 feet high, the separate stems 8 to 10 inches thick, now becomes very abundant on the bottom.

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* Owing to the variable forms they affect, there is still some uncertainty in the differentiation of the Poplars of the Southwest.

The Ash already seen at El Paso is occasionally met with; it is planted in the streets of Isleta and San Elizario, its quick growth and spreading limbs making it a valuable shade tree. The Mexican Elder (*Sambucus Mexicana*) also found in these towns may have been imported.

Below San Elizario, the valley remains broadly open down to old Fort Quitman. The water, however, is not always abundant or of good quality and, during dry seasons, disappears in places; the soil is also more barren. Large groves of Cottonwood, often continuous, cover the alluvial bottom.

Atriplex canescens, under several marked forms, grows thickly on sandy and gravelly banks; common also are the other Chenopods, *Atriplex acanthocarpa* and *expansa*, often in the company of the weedy *Acanthochiton Wrightii*. *Ephedra antisyphilitica* and *trifurca* (Cañatilla) are never rare on the foot-hills with the Creosote-bush and cylindrical Opuntiæ. Nearer the edge of the river are thickets of *Baccharis cœrulescens*, *Pluchea borealis*, and that most common of bushy weeds *Aster spinosus*.

At Quitman, the prevalent grasses are *Hilaria mutica* and *Bouteloua oligostachya* (Common Grama).

Below this point the valley becomes contracted and does not admit of farming as far down as Ruidoso. The Cottonwood continues to be abundant, although now with increasing distances between the groves. From the summit of Eagle Mountain it can be traced along the valley from Ojo Caliente into Vieja Cañon; it is dense at the mouth of Capote Creek; thence, with few interruptions, extends to Presidio del Norte, forming large woods a few miles above this town.

The valley is more or less settled between Ruidoso and Presidio, and under irrigation yields good wheat, corn, and vegetables. Fifteen miles from the latter place is the village of Polvo, at the foot of the Bofecillos; thence to Del Rio there is no other agricultural settlement.

Below Presidio, the Cottonwood is much less frequent; small clumps are seen at long intervals. It disappears in the Great Cañon, where no arborescent vegetation of any kind is possible, but reappears below it, forming large groves a few miles from the mouth of the Tarlinga, southwest of the Chisos Mountains. At this point, the broad valley, abundant water and rich alluvial soil offer great inducements to settlers. Thence the Cottonwood is more sparse, but still occurs in scattered clumps as far as the Sierra Carmel, below the abandoned Presidio de San Vicente. Here the river enters another series of cañons, a hundred miles long, and as it issues from the highlands, near the mouth of the Pecos, it is bare of Cottonwood and remains so to its mouth.

At Presidio del Norte (953 miles from the mouth of the Rio Grande, altitude 2,780 feet) the broad valley and adjoining terraced table-lands are encompassed by steep hills and craggy mountains bare of all visible arborescent growth, the whole forming a vast landscape of utter dreariness and desolation.

The vegetation is that peculiar to the great Texano-Mexican Desert. The sparse trees are confined to the alluvial bottom and dependent ravines; they are Cottonwood, Hackberry, Mesquite, Screw Bean and Willow (*Salix longifolia* and *nigra*). Shrubs and bushes are common enough, but in scattered thickets nowhere forming a dense chaparral; those preponderating on mesas and hills are:

Acacia Greggii and *constricta.*
Mimosa borealis and *biuncifera.*
Dalea formosa.
Condalia obovata and *spathulata.*
Zizyphus obtusifolius.
Kœberlinia spinosa.
Celtis pallida.
Lycium Carolinianum, Berlandieri, puberulum.
Mozinna spathulata.
Ephedra antisyphilitica and *trifurca.*
Larrea Mexicana.
Flourensia cernua.
Yucca angustifolia.

The Palmo (*Yucca baccata*, var. *australis*), with tall caudex, 10 to 20 feet high and 1 to 2 feet in diameter, covers the broad graded incline extending from the valley to the Chenate Mountains. The obnoxious Lechuguilla (*Agave heteracantha*) is everywhere but too common. The Bear-Grass or Sotol (*Dasylirion Texanum*) is also conspicuous. Of the abundant Cacti the most remarkable species are: *Anhelonia fissurata* (Pellote) bearing a beautiful flower and used medicinally by Mexicans; *Anhelonia Williamsii* not before observed on this side of the Rio Grande; *Cereus Greggii*, one of the most ornamental of its class; *Cereus stramineus* (Strawberry Cactus) with large, red, delicious fruit.

The bottom is covered with such weeds as—

Nama hispidum.
Solanum nigrum and *elæagnifolium.*
Portulaca oleracea, retusa, lanceolata.
Petunia parviflora.
Sida hederacea.
Cucurbita perennis.
Lippia nodiflora.
Tribulus maximus.
Rumex Berlandieri.

And also the following Composites:

Helianthus lenticularis and *ciliaris.*
Verbesina encelioides.
Aster spinosus, tanacetifolius and *canescens.*
Coreopsis cardaminefolia.
Aplopappus spinulosus.
Gutierrezia Texana.
Helenium amphibolum.

More conspicuous and interesting herbs are—

On the bottom:

Collomia longiflora.
Tribulus grandiflorus.
Martynia altheæfolia.
Œnothera triloba and *pinnatifida.*
Argemone hispida.
Hoffmanseggia stricta.
Sphæralcea angustifolia.
Tetraclea Coulteri.
Lepidium alyssoides.
Philibertia cynanchoides and *linearis.*

On the mesas:

Talinum aurantiacum.
Lœselia Havardi, Gray.
Cassia bauhinioides.
Mentzelia multiflora.
Talinopsis frutescens.
Baileya multiradiata.
Riddellia tagetina.

The coarse "Maton" grass (*Sporobolus Wrightii*), on which many of the native ponies feed in winter, occupies large portions of the open bottom. The grazing is very poor in the valley and on the low mesas; it is only in the foothills that we find nutritive Grasses, principally *Bouteloua oligostachya* and *polystachya*, *Cathestechum erectum*, *Aristida purpurea.*

Here the Rio Grande receives its largest affluent, the Rio Conchas, having its source nearly due south in the Sierra Madre of Chihuahua. The valley of this fine river is very fertile, and, under irrigation, produces abundant cereals, vegetables, and fruits, on which subsist many towns and villages from Presidio del Norte to Chihuahua.

An excursion of about 40 miles through and beyond the Cañon of the Conchas did not reveal any notable change. The country, outside of the river bottom, is a hopeless desert extending to the very mountains surrounding the City of Chihuahua. In this desert we found a flourishing Sotol-mescal factory, the favorite alcoholic beverage of frontier Mexicans, made from the Sotol or Bear-Grass.

On February 14, 1881, I was surprised to see the Cottonwood on the Conchas already quite green, while those of the Rio del Norte, on the other side of the dividing ridge were still a bare, blackish mass. I subsequently ascertained that the difference in the advance of vegetation between the two valleys is three or four weeks, and found an easy explanation for it by taking the temperature of their respective streams. Thus, on February 21, between 9 and 10 o'clock a. m., the temperature of the Rio del Norte, just above the junction, was 49°, while that of the Conchas was 58°, and that of the conjoined rivers (now Rio Grande) 55°.

These observations testify to the remarkable influence of a few degrees of heat in the moisture of the subsoil upon early vernal vegetation.

From Presidio one sees a lofty mountain to the southeast, Sierra Rica, 9,000 feet or more in altitude, probably the highest in the State of Chihuahua. Its summit is covered with Nut Pine of large size (or its Mexican kin, *Pinus cembroides*), and its slopes with *Quercus grisea* (Gray Oak) and *Arbutus Xalapensis.*

Below Presidio the river enters a series of deep cañons not yet thoroughly explored. Vegetation within them is scant, sometimes entirely absent. Two rare and pretty shrubs, *Cowania ericæfolia* (rediscovered by me on Tornillo Creek) and *Emorya suaveolens*, were found hereabout by the botanist of the Boundary Survey. Below the Bofecillos Mountains, on gravelly mesas, the *Eriogonum Havardi*, Watson, is conspicuous with its semi-globular masses of leaves from which spring many slender, diverging stems. With it, but much rarer, was found a new species, *E. suffruticosum*, Watson. In the cañon leading to the San Carlos Crossing I rediscovered the *Acacia Schottii*, apparently at the identical place where first seen by Dr. Parry. In the same cañon were collected a new species of *Boerhaavia* (*B. bracteosa*, Watson), the pretty *Bouchea linifolia*, the rare *Mimosa fragrans*, and, nearer the river, a giant form of *Acacia filicina*, 6 to 8 feet high, forming a dense thicket.

Opposite the mouth of the Tarlinga, the Rio Grande issues from the Great Cañon through a narrow chasm into which one may advance, creeping under the overhanging walls, nearly half a mile. Here *Salvia Henryi* and *Nama undulatum* are common.

Near the mouth of the Tarlinga, on low sand banks, was found, with ripe and excellent fruit, the Watermelon (*Citrullus vulgaris*), which has become extensively naturalized in Western Texas.

Growing on the immediate shore, and first observed as a native plant north of the Rio Grande, is the beautiful Tobacco-Shrub (*Nicotiana glauca*), and on neighboring gypseous hills that rare and curious shrub *Salazaria Mexicana.* Farther down, in foot-hills nearly opposite San Vicente, was collected a new species of a Mexican genus, *Brongniartia minutifolia*, Watson.

Del Rio is a promising agricultural village, where, among other fruits, delicious peaches are raised. From this point almost down to Eagle Pass the fertile and wide valley seems well adapted to farming. Settlements occupy the several creeks watering it.

At Eagle Pass, distant 495 miles from the mouth of the river, altitude 1,460 feet, the general aspect of the vegetation remains the same but a close examination reveals changes. The Bear-Grass has disappeared, and the giant *Yucca baccata* is dwarfed to a mere tuft of leaves. *Acacia Greggii* and *constricta* of the gravelly mesas of Presidio are here replaced by *Acacia amentacea*, *Berlandieri*, *Coulteri*, and *Wrightii.* The Mezquit is as common as ever, shading the parade ground of old Fort Duncan, ts gnarled branches often loaded with thrifty bunches of Mistletoe

(*Phoradendum flavescens*). The Screw Bean is no longer seen. Here begin the Retama (*Parkinsonia aculeata*) and Huisache (*Acacia Farnesiana*), elegant trees becoming more frequent and of larger size below. Common and conspicuous are the thorny, yellow-flowered *Parkinsonia Texana;* the white-leaved, purple-flowered *Caulophyllum Texanum;* the fragrant *Lippia lycioides* and *graveolens;* the Majorano (*Salvia ballotæflora*), and the Guayacan (*Porliera angustifolia*). The other shrubs are:

Calliandra conferta.
Castela Nicholsoni (Goat-bush).
Shæfferia cuneifolia.
Bumelia lanuginosa and *spinosa.*
Lantana macrocarpa and *Camara.*
Diospyros Texana (Persimmon).
Mozzina spathulata (Sangre de dragon).
Larrea Mexicana (Creosote-bush).
Flourensia cernua.
Lycium Carolinianum.
Celtis pallida (Granjeño).
Forestiera angustifolia.
Kœberlinia spinosa (Junco).
Condalia Mexicana, obovata, spathulata.
Colubrina Texensis.
Zizyphus obtusifolius.

The following climbers are characteristic:

Ipomœa sinuata.
Clematis Drummondii.
Philibertia cynanchoides.
Maximowiczia Lindheimeri.
Passiflora tenuiloba and *fœtida.*
Roulinia unifaria.
Cuscuta decora.

In the early summer the bottom is covered with the flowers of *Callirrhoë involucrata, Œnothera speciosa, tetraptera* and *sinuata, Anemone hispida* (with purplish flowers), *Phacelia Popei, Monarda citriodora* and *punctata, Gaillardia pulchella, Dichetophora campestris, Helenium amphibolum* and *ooclinium.*

Other herbs, growing in various situations, are:

Neptunia pubescens.
Dalea lasiathera.
Psoralea rhombifolia.
Malvastrum leptophyllum, tricuspidatum, pedatifidum.
Sphæralcea hastulata.
Melochia pyramidata.
Hermannia Texana.
Galphimia linifolia.

Asclepias longicornu.
Jatropha Berlandieri.
Talinum sarmentosum.
Oxalis dichondræfolia.
Ionidium lineare.
Siphonoglossa Pilosella.
Aristolochia longiflora.

And also the following Composites:

Conoclinium dissectum.
Varilla Texana.
Aphauostephus ramossissimus.
Gymnosperma corymbosa.
Chætopappa modesta.
Encelia subaristata.
Gutierrezia eriocarpa.
Palafoxia Texana.
Bigelovia coronopifolia.
Verbesina encelioides.

The prevalent Grasses are:

Buchloe dactyloides (Buffalo-Grass).
Bouteloua oligostachya, *Texana*, *polystachya*, *Humboldtiana.*
Chloris cucullata.
Panicum lachnanthum, *autumnale*, *virgatum*, *crus-galli.*
Hilaria cenchroides and *mutica.*
Eragrostis megastachya and *reptans* var. *capitata.*
Triodia mutica.
Andropogon scoparius and *contortus.*
Pappophorum vaginatum.
Paspalum læve.
Cenchrus myosuroides.
Spartina gracilis.
Arundo Donax.
Sporobolus Wrightii.

Three miles below Eagle Pass, the Rio Escondido, on the Mexican side, empties into the Rio Grande. It is a clear, swift stream shaded with Pecan, Hackberry, and Wild Mulberry (*Morus microphylla*), over which climb luxuriantly the Mustang Grape (*Vitis candicans*) and a quinquefoliate form of Poison Ivy. On the bluffs above are groves of fine Live Oak extending thence, along the hill tops, into the interior of the State of Coahuila.

The general features of the vegetation do not change much down to Laredo. The narrow valley, sparsely fringed with timber, is contained within lines of broken bluffs, or cuts its course through high, gravelly mesas. It expands at rare intervals, affording farming land to a few ranches. The shrubbery becomes denser, larger, and extends farther

from the river; it now forms a tolerably well defined wooded belt which runs parallel with the river to its mouth and spreads north of it from 20 to 40 miles.

Laredo stands on a broad and level sandy plain over which it has been projected to convey the waters of the Rio Grande. Mezquit continues to be the prevalent shrub; the Huisache (*Acacia Farnesiana*) and Retama (*Parkinsonia aculeata*) are much more common; the Colima (*Xanthoxylum Pterota*) begins to appear. In gardens and yards are noticed the elegant Tobacco-Shrub (*Nicotiana glauca*) of arborescent size, and the Mexican Maguey (*Agave Americana*). The river shore is mostly bare; at intervals are clumps of Black Willow, Hackberry, Water Elm (*Ulmus crassifolia*), and Texas Green Ash (*Fraxinus viridis*, var. *Berlandieriana*). Along the water's edge was collected a genus of Grass (*Hemarthria*) new to the United States.

Proceeding on the narrow-gauged railroad toward Corpus Christi, one crosses the undulating, hilly wooded belt, the shrubs being: Mezquit, Huisache, Granjeno, Hackberry, Texas Persimmon, *Parkinsonia aculeata* and *Texana*, *Condalia obovata* and *Mexicana*, *Acacia amentacea* and *Wrightii*, *Karwinskia*. Here also begin to be seen, in the wild state, rare patches of Maguey (*Agave Americana*), which, as a native plant, grows very sparsely on the Texas side of the Lower Rio Grande. The Nopal (mostly *Opuntia Engelmanni*), of very thrifty growth, is every where abundant in the woods which it sometimes renders impassable.

Opposite Belleville, the Salado, one of the largest rivers of Northern Mexico, flows into the Rio Grande. At the time of the Boundary Survey, Cypress (*Taxodium distichum*) was rather common on its shores and extended down the Rio Grande to Roma. It is quite sparse now but is occasionally noticed as far down as Edinburg. At Havana Ranch I saw a fine specimen of this tree 2 feet in diameter.

Below Belleville, bluffs and high mesas gradually recede while the valley widens; much of it now is susceptible of cultivation. Roma is the head of high-water navigation, while Rio Grande City is generally reached by steamers at all stages of water.

At Rio Grande City (Ringgold), the woody vegetation on the neighboring bluffs and throughout the river belt, 30 miles or more wide, is dense, and in low places reaches the magnitude of scrub timber. The nature of it has changed; one now commonly sees: Nacahuite (*Cordia Boissieri*), a small tree with large, mulberry-like leaves and excellent fruit; Barretta (*Helietta parvifolia*), which, although a common shrub here, had not before been observed in the United States; Ebony (*Acacia flexicaulis*), an evergreen shrub or small round-headed tree 1 foot in diameter; Colima (*Xanthoxylum Pterota*), spiny shrub with pungent leaves; more rarely *Ptelea angustifolia*. The other shrubs also growing in this locality have already been noticed. They are Mezquit, Texas Persimmon (Chapote of the Mexicans), Granjeno, Guayacan, Junco, of arbor-

escent size; Coyotillo (*Karwinskia*), Amargoso (*Castela Nicholsoni*), *Zizyphus*, *Acacia Berlandieri* and *amentacea*, only shrubby.

In the woods below Ringgold the *Agave variegata* was found. Much cultivated about yards are the Mexican Maguey (*Agave Americana*) and several forms of *Agave rigida*.

The valley of the Rio Grande, from 3 to 4 miles wide at Rio Grande City, becomes a broad alluvial plain below Edinburg. It is thinly but almost continuously settled from Roma to Brownsville. It produces, with little or no rain, excellent crops of Sugar Cane, Cotton, Corn, and all kinds of vegetables except Potato.

The timber of the alluvial bottom is now quite thick in places, completely and most pleasantly shading roads for miles. At Rio Grande City, and downward to Brownsville, it consists of: Black Willow (*Salix nigra*), often 2 and 3 feet in diameter and from 50 to 70 feet high, bearing some resemblance to the Cottonwood of the middle and upper river; Long-leaved Willow (*Salix longifolia*), much smaller than the preceding; Water Elm (*Ulmus crassifolia*), of good size; Green Ash (*Fraxinus viridis*, var. *Berlandieriana*), 2 and 3 feet in diameter and 50 feet high; Huisache and Retama, middle-sized trees; Anaqua (*Ehretia elliptica*), 1 to 2 feet in diameter, with deep green, scabrous foliage and edible berries; Coma (*Bumelia lycioides*), becoming a tree 1 foot in diameter and 30 feet high; Uña de Gato (*Acacia Greggii*), 8 to 10 inches in diameter and 30 feet high; Brasil or Blue-wood (*Condalia obovata*), shrub or small tree; Huajillo (*Pithecolobium brevifolium*), spiny shrub whose foliage is eaten by goat and sheep; Granjeno (*Celtis pallida*), arborescent shrub whose twisted branches are much sought after for canes; *Sesbania Cavanillesii*, very graceful shrub or small tree with bunches of yellow flowers in August and winged legume; Pecan, a large tree, only at a few places, and probably introduced.

Common and pretty vines are *Ipomœa sinuata* and *trifida*, *Cocculus diversifolius*, *Vitis incisa*, *Anredera scandens*, and *Vigna luteola*.

At Havana Ranch (below Ringgold), late in August, I noted the following plants in bloom:

Talinum sarmentosum.
Iva ciliata.
Acleisanthes Berlandieri, reclining over low bushes.
Lippia geminata, erect, 3 to 4 feet high.
Salvia coccinea.
Mimosa strigillosa.
Teucrium Cubense.
Solanum tectum. ?
Sesbania Cavanillesii.
Vigna luteola.
Martynia fragrans.

Below Edinburg one is surprised at the unexpected appearance, in small, sparse clumps, of a Palmetto (*Sabal Palmetto* ?) with the habit

and proportions of the South Carolina tree. The Long Moss (*Tillandsia usneoides*), found as far west as San Antonio, becomes a marked feature of the vegetation near the coast.

At and about Brownsville the most common trees are, as above, Retama, Huisache, Hackberry, Willow, and Mezquit, the latter extend ing down the river nearly to its mouth.

HILLS, BLUFFS, AND MESAS.

The most widespread and common tree on hills and bluffs, from the Canadian River to the Rio Grande, is the Red Cedar (*Juniperus occidentalis* and var. *conjungens*), generally of small size and gnarled growth. Next in frequency is the low round-headed Gray Cak (*Quercus grisea*), particularly conspicuous on the grassy bluffs southwest of Marfa. The Post Oak (*Q. stellata*) is found on ridges near the Gulf Coast and, in thin groves, on high ground farther inland, north of the Nueces River. It is a good-sized tree in the Buffalo Gap Mountains, south of Abilene, its extreme western limit in Texas. The Red Oak (*Q. rubra*) often extends from valleys to the base of hills and mountains but is nowhere large or abundant. The shrubby *Q. undulata* begins at the Pecos River and occurs occasionally in clefts of rocky bluffs along the Rio Grande.

On some of the high ridges and peaks of the mountainous region north of the Chisos Basin, from the Santiago Range to Peña Colorado, and thence nearly to Fort Davis, are seen small scattered Nut Pine (*Pinus edulis*), and, at a lower altitude, clumps of shrubby Ash (*Fraxinus cuspidata* and *Greggii*) and Mulberry (*Morus microphylla*). Nut Pine is also sparingly found on the bluffs of the forks of Nueces River and further north along the edge of the escarpment of the Staked Plains.

Very prominent on foot-hills and bluffs are: the Bear-Grass or Sotol (*Dasylirion Texanum*), the pestilent Lechuguilla (*Agave heteracantha*), the handsome Jacob's Staff or Ocotillo (*Fouquiera splendens*) whose thorny shoots are tipped with racemes of scarlet flowers, the forbidding Spanish Bayonet or Palmo (*Yucca baccata*) in all stages of growth, the smaller *Yucca angustifolia*, the tufty *Nolina Texana* and *erumpens*.

On low slopes and banks of ravines abounds the Texas Persimmon (*Diospyros Texana*), and common are several species of Sumach (*Rhus microphylla, trilobata* and *virens*).

On the craggy, limestone hill-sides of the west, we find habitually the Sangre de Dragon (*Mozinna spathulata*), the leafless *Euphorbia antisyphilitica*, the bushy *Mortonia scabrella*, the long-tubed *Macrosiphonia Berlandieri*, the curious moss-like Siempre Vive (*Selaginella lepidophylla*) and its congener *S. rupestris*, several Ferns (*Notholæna* and *Pellæa*).

In the Great Bend of the Rio Grande, the bluffs are often covered with decayed argillaceous schist, giving them a repulsive blackish and cindery appearance. Even then they are seldom entirely bare but mostly

dotted with white bunches of Common Grama interspersed among thick patches of Lechuguilla. About their bases are thickets of *Atriplex acanthocarpa* and *canescens; Selinocarpus diffusus, Ephedra, Larrea, Flourensia;* more rarely *Clappia suædæfolia*, and always more or less *Cactaceæ.* Somewhat special to the gravelly hills of the Great Bend are: *Ayenia Microphylla, Cladothrix suffruticosa, Bouchea spathulata, Cowania ericæfolia, Boerhaavia eriosolena, Hibiscus Coulteri, H. denudatus* (var. *involucellata*), *Lycium pallidum, Prunus minutiflora.* On the bluffs of the Rio Grande, south of the Chisos Mountains, mixed with Lechuguilla and nearly as forbidding, was collected a new species of a genus not before observed in the United States—*Hechtia Texensis*, Watson.

Mesas are covered with:

Prosopis juliflora.
Zizyphus obtusifolius.
Condalia obovata and *spathulata.*
Larrea Mexicana.
Ephedra antisiphylitica and *trifurca.*
Flourensia cernua.
Kœberlinia spinosa.

The *Leucopyhllum Texanum*, so strikingly beautiful with its purple flowers and white foliage, is very abundant on high plains west of Uvalde; in the Great Bend it is often mixed or replaced by its still handsomer kin *Leucophyllum minus.* Likewise highly ornamental is the spinose *Parkinsonia Texana* on the Lower Rio Grande, and the scented *Buddleia marrubiifolia* farther west.

Other shrubs likewise common, and characteristic of bluffs and high mesas, are:

Acacia Berlandieri, Greggii, constricta, amentacea.
Cassia Wislizeni (west of the Pecos).
Mimosa biuncifera, borealis, Lindheimeri, dysocarpa, monancistra.
Eysenhardtia amorphoides.
Dalea formosa.
Forestiera angustifolia, Neo-Mexicana, pubescens (east of the Pecos).
Salvia ballotæflora.
Coldenia Greggii, canescens, hispidissima.
Lippia lycioides, Wrightii, graveolens.
Cercocarpus parvifolius.
Talinopsis frutescens.
Castela Nicholsoni.
Microrhamnus ericoides.
Krameria canescens, parvifolia, lanceolata.
Berberis trifoliata.
Parthenium incanum.
Yucca rupicola (east of Devil's River).

Of herbaceous plants, the most conspicuous belong to the genera

Mentzelia, Œnothera, Boerhaavia, Acleisanthes, Dalea, Cassia, Greggia, Vesicaria, Abutilon, Menodora, Eriogonum, Croton, Euphorbia, Riddellia, Baileya, Zinnia, Liatris, Aplopappus, Pectis.

In ravines and cañons are commonly seen several pretty trailers like *Janusia gracilis, Rhynchosia Texana, Phaseolus angustissimus* and *atropurpureus;* the Scarlet Sage (*Salvia Greggii*), the showy *Tecoma stans,* and *Eucnide bartonioides.*

Cactaceæ are never wanting on broken uplands; the most common species are: *Mamillaria macromeris, meiacantha, tuberculosa, Heyderi; Cereus stramineus,* the noted Strawberry Cactus, under several forms; *C. chloranthus, paucispinus, enneacanthus; Echinocactus longehamatus* (Turk's Head), often a foot in diameter, yielding delicious fruit hardly inferior in size or quality to that of *Cereus stramineus; E. horizonthalonius, intertextus; Opuntia frutescens, arborescens, Grahami,* and several flat-jointed species.

Nutritious Grasses, often sparse or absent in valleys, generally cover bluffs and hills. The Common Grama (*Bouteloua oligostachya*) is by far the most abundant. Other common species are *Bouteloua hirsuta, polystachya* and *Havardi; Cathestechum erectum* (first time collected north of the boundary line); *Andropogon scoparius* and *saccharoides; Aristida purpurea* and *dispersa; Elionorus ciliaris; Muhlenbergia distichophylla.*

STAKED PLAINS.

Under the name of Staked Plains is comprised the vast, rather ill-defined plateau south of the Canadian River Basin and east of the Pecos; this river, bending eastward, also forms its southwest boundary. It ends abruptly, by a sudden fall of several hundred feet, on the north where drained by the Canadian, and on the east where drained by the many heads of the Brazos and Red River. Judging from the general direction of the water-courses, this plateau slopes down insensibly towards the south and east. There is no topographical feature separating it on the southeast from the sandy plains of the Colorado and Concho Rivers. On the Texas Pacific Railroad, the traveler may be said to enter the Staked Plains at about Big Spring, although, at this latitude, the escarpment so conspicuous farther north is hardly perceptible.

There is no stream on the Plains. Salt lakes, ponds and holes, rarely fresh-water springs, are found in the long-winding cañons and valleys which open into the rivers named above. At several places along the Texas Pacific Railroad excellent water in fair abundance was struck at a depth of about 50 feet. It is quite probable that water could be obtained by digging or boring over many portions of the Plains. The western belt, along the Pecos, unsuccessfully bored by Captain Pope in 1856, seems in this respect the most unpromising.

The Northern Plains consist mostly of level or undulating prairies covered with good grass. Large bodies of cavalry have several times

traversed them without enduring special hardships or privations. They have but few sand belts and grass seldom fails; the only apprehension in dry seasons is about potable water.

The Southern Plains are much more barren; they include the notorious Sand Hills and large arenaceous sterile areas entirely destitute of surface water. No one can venture over them without running serious risk from scarcity of water, or sand-storms.

Big Spring is on the southeastern edge of the plains. This very remarkable spring, by far the most important between the Colorado and the Pecos, issues from under a cliff at the head of a ravine. In this as in the many other ravines running into the dry arroyo called Giraud's Creek, there is more or less arborescent vegetation. Hackberry and Willow predominate; Red Cedar and Gray Oak are common on the hills but neither of useful size. Conspicuous on the slopes are the tall *Eriogonum alatum*, the humbler *E. Jamesii*, the bushy *Hymenatherum acerosum*, and on the plains below the showy *Aplopappus ciliatus* and *Eryngium Leavenworthii*. One or two species of *Aristida*, *Bouteloua*, *Sporobolus*, and *Triodia* are the ordinary grasses.

For several miles west of Big Spring there is a thick growth of shrubby Mezquit; it becomes gradually thinner and disappears about 18 miles out. The flat, barren plains show large bald areas; patches of *Panicum obtusum* and *Brizopyrum spicatum* here and there cover the alkaline soil.

Mustang Spring lies in one of the drains of the Concho, where crossed by the Texas Pacific Railroad. Here brackish water gravitates into a small basin and is obtained at a depth of a few feet. This basin is covered with *Helianthus lenticularis*, *Aplopappus rubiginosus*, *Flaveria* ———, *Bigelovia Wrightii*, and *Sporobolus airoides*. On surrounding mesas is a fair amount of Common Grama.

Following the railroad (past Midway Station) over the level prairie, burned in places by locomotive sparks, I noted the trailing *Tribulus maximus*, the common weeds *Nama hispidum* and *Coldenia hispidissima*, the pretty and ephemeral *Portulaca pilosa* and a homely form of *Œnothera Greggii* with blotched ovate leaves.

Odessa Station stands in the midst of a prairie district, and as the vegetation hereabout is more or less typical of that of the better parts of the Staked Plains I shall briefly describe it. Bushes are scant and dwarfed; they consist of Mezquit only 1 or 2 feet high, a very slender form of *Yucca angustifolia*, the Creosote-bush (*Larrea Mexicana*), the Lote-bush (*Zizyphus obtusifolius*), Canatilla (*Ephedra trifurca*). The most common non-ligneous plants are:

Verbena canescens and *bracteosa*.
Nyctaginia capitata.
Allionia incarnata.
Solanum elæagnifolium.
Physalis hederæfolia, and *mollis*, var. *cinerascens*.
Croton corymbulosus and *Texensis*.

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Euphorbia versicolor.
Aphora Neo-Mexicana.
Phyllanthus polygonoides.
Argyrothamnia Neo-Mexicana.
Œnothera Hartwegi and *Greggii.*
Mentzelia nuda.
Hoffmanseggia stricta and *Jamesii.*
Dalea nana.
Psoralea tenuiflora.
Collomia longiflora.
Plantago Virginica.

Also the following Composites:

Riddellia tagetina.
Gutierrezia eriocarpa.
Stephanomeria minor.
Grindelia squarrosa.
Helianthus ciliaris.
Melampodium cinereum.
Thelesperma gracile.
Gaillardia pulchella.
Pectis angustifolia and *papposa.*
Lindheimeria Texana.
Zinnia grandiflora.
Lygodesmia aphylla.

And the following Grasses:

Bouteloua oligostachya, hirsuta, racemosa, eriopoda.
Aristida purpurea and *stricta.*
Andropogon saccharoides.
Chloris cucullata.
Eragrostis poœoides, var. *megastachya.*

On the bluffs edging the northeastern border of the Plains, we find a few Nut Pine (*Pinus edulis*), many straggling groves of small Cedar (*Juniperus occidentalis*), dwarf Gray Oak (*Quercus grisea*) and var. *pungens* of *Q. undulata.* The grass is abundant and nutritious.

West of Odessa, about 20 miles, the sand zone begins, running south and east nearly to the Pecos, and north to the very center of the Plains. In this zone are the Sand Hills, a dreary, chaotic belt of reddish sand tossed by the wind into hillocks, cones and ridges of various sizes and shapes. In these dunes I found but four shrubs: Mezquit, of a rather vigorous growth, hinting at the presence of water in some substratum within the reach of its long, penetrating roots; a "Shin" Oak, form closely allied to var. *Jamesii* of *Quercus undulata*, spreading into a low thicket, with shallow, strongly tuberculated cups and very large, edible acorns;

the slender-stemmed *Acacia constricta*, and the ample-panicled *Bigelovia pulchella*. Common also is a narrow-leaved, large-fruited form of *Yucca angustifolia*.

The other plants noted in the Sand Hills are: *Œnothera trichocalyx*, *rhomboidea* and *serrulata*; the tall *Gaura villosa*, with crisp, silvery leaves; a large-flowered flax (*Linum Berlandieri*); the showy *Heliotropium convolvulaceum*; the remarkable spectacle-fruited *Dithyræa Wislizeni*; a small-flowered form of *Jatropha Texana*, and—*Cristatella Jamesii*, *Hoffmanseggia Jamesii*, *Dalea lanata*, *Abronia fragrans*, *Oxybaphus angustifolius*, *Pentstemon ambiguus*, *Oldenlandia humifusa*, *Artemisia Canadensis* and *filifolia*, *Gaillardia pulchella*, *Palafoxia Hookeriana*.

The only Grasses seen were a stout *Andropagon* (near *A. furcatus*), 3 to 5 feet high, with running roots holding the loose soil in their meshes; a *Sporobolus* (probably form of *S. cryptandrus*), likewise erect and tall; and a large form of *Cenchrus myosuroides*.

PRAIRIES.

East of the Staked Plains, above, and of the Pecos, below, the land of Western and Southern Texas, either as broken plain or undulating prairie, is more or less covered with nutritious grass, and its capability for the raising of stock is chiefly limited by the water supply.

In the Pan Handle the grass is abundant and nutritious, but water is scant away from the Canadian and the forks of the Red River.

West of the Pecos there is a vast prairie region bounded about as follows: East, by a line running from the mouth of San Francisco Creek to Fort Davis; north, by the Limpio Mountains and the line of hills and bluffs extending thence to Sierra Blanca; west and south, by the mountain ranges lining the valley of the Rio Grande, viz., Eagle, Vieja, Capote, Chenate, Bofecillos, and Chisos Mountains, thus excluding the Rio Grande Valley and the Chisos Basin. Within these limits the grass can hardly be excelled. Unfortunately water is very scarce; there is no running stream, permanent springs are few, and most of the water-holes give out in dry seasons. There is hardly any doubt that in many places an abundant supply could be obtained by boring, as at Marfa. This prairie region is traversed by many ranges of hills and bluffs, and cut up by many arroyos and ravines; much of it, however, is simply undulating or nearly level. At Marfa, the eye ranges in all directions over a vast expanse of meadow land, level and smooth like a sea of grass.

Other excellent prairie land, west of the Pecos, deserves mention: A large area watered by Independence Creek and extending thence towards Meyer's Spring; the Delaware Creek Basin, and the eastern base of the Guadalupe Mountains north of this creek; the belt from the Cornudas to the Hueco Mountains extending north and south many miles.

West of the Santiago Range, between it and San Jacinto Peak, is a vast plain, timberless and waterless, but mostly covered with good grass. If water could be struck in places by boring, or collected in tanks, it would afford miles of excellent pasturage.

The gramineous vegetation of the prairie consists chiefly of the following species, arranged as far as possible in the order of their worth:

Buchloe dactyloides (Buffalo-Grass), east of the Pecos.
Bouteloua oligostachya, *hirsuta*, *eriopoda*, *racemosa* (Gramas).
Pappophorum Wrightii.
Triodia acuminata and *pulchella.*
Hilaria mutica (north) and *cenchroides* (south).
Aristida purpurea, *dispersa*, *Schiediana*, *stricta.*
Muhlenbergia Texana and *arenicola.*
Andropogon saccharoides and *scoparius.*
Lycurus phleoides.
Panicum obtusum, *leucophæum*, *Hallii.*
Setaria caudata.

The prairie, although apparently smooth, is seldom entirely free from shrubby plants, of which the most common are: A slender, straggling form of *Clematis Drummondii*; a small, branching variety of *Acacia filicina* (*A. Hartwegi* of Bentham); dwarf Mezquit, *Microrhamnus ericoides*, *Zizyphus obtusifolius*, *Ephedra trifurca* and *antisyphilitica*, *Larrea Mexicana*, *Yucca angustifolia*, *Nolina Texana*, *Opuntia arborescens.*

During the summer the prairie is decked with the blossoms of the following herbs:

Talinum aurantiacum.
Calophanes linearis.
Linum Berlandieri and *rigidum.*
Callirrhoë pedata and *digitata.*
Sida physocalyx and *diffusa.*
Sphæralcea hastulata.
Nyctaginia capitata.
Abronia turbinata.
Oxybaphus angustifolius and *aggregatus.*
Cooperia Drummondii.
Phaseolus retusus.
Rhynchosia Texana.
Petalostemon candidus and *multiflorus.*
Verbena bipinnatifida.
Chamæsaracha Coronopus.
Solanum elæagnifolium.
Tradescantia Virginica.
Commelina Virginica and *dianthifolia.*
Salvia lanceolata.

Tetraclea Coulteri.
Eriogonum annuum.
Croton corymbulosus.
Asclepias Jamesii.
Senecio longilobus.
Gaillardia pulchella.
Riddellia tagetina.
Aplopappus spinulosus.
Gutierrezia criocarpa.
Lygodesmia aphylla.
Aster tanacetifolius.
Thelesperma gracile.

That large portion of Southeastern Texas included between the coast, the Rio Grande and the Nueces River, is a sandy, dry, riverless country, but mostly covered with fair grass, and therefore entitled to consideration under the heading of prairie. On account of its peculiar vegetation I have deemed best to describe it separately.

Zones of chaparral and small timber traverse it in several directions, and trees of good size: Hackberry, Mezquit, Huisache, rarely Water Elm and Green Ash, fringe the dry forks and beds of the Olmos, San Diego, and Banquete Creeks. The absence of surface water and the uncertainty of obtaining it by deep boring, render the settlement of much of this vast region problematical.

Following the narrow-gauged railroad from Laredo, one crosses the chaparral belt, extending nearly 40 miles out; then begin undulating plains of red sand covered mostly with a coarse bunch-grass (stout, nearly smooth, form of *Elionurus ciliatus*); *Aristida purpurea* and *Sporobolus cryptandrus* are also common, and always abundant about settlements the very obnoxious Sand-bur (*Cenchrus tribuloides*). Near the Rio Grande and the coast, the Texas Grama (*Bouteloua Texana*) and Bermuda Grass (*Cynodon Dactylon*) are common, while the Common Grama (*Bouteloua oligostachya*) is only rarely seen.

The open, grassy plain is about 35 miles in width, measured by the railroad track. Ten or 15 miles east of Peña Station the shrubbery begins again and grows denser and larger until San Diego is reached. Farther on, it decreases and dwindles down to scrubby chaparral, which in places entirely disappears, leaving the ground covered with thin and sparse grass or, in dry seasons, quite bare. Beyond Collins the level land is lined for miles with a thick sod of excellent grass.

On approaching Corpus Christi the chaparral becomes thicker, but remains low and stunted. Clumps or "motts" of Live Oak occur farther south on the sandy plains between the Olmos, the Rio Grande, and the coast; the trees are small and not of much account.

Peña Station stands in the midst of the central grassy plain described above. The loose, sandy soil is mostly covered with the form of *Elio-*

nurus ciliatus already mentioned. Late in August I noted about here the handsome *Lantana Camara*, which cattle seem to avoid, the stinging *Jatropha Texana*, the purple-flowered *Callirrhoë involucrata*, and several pretty Leguminosæ, viz., *Hoffmanseggia caudata*, *Cassia procumbens*, *Zornia tetraphylla*, *Indigofera leptosepala*, *Tephrosia Lindheimeri*. Other conspicuous plants were *Heliotropium convolvulaceum*, *Commelina Virginica*, *Palafoxia Hookeriana*, *Gaillardia pulchella*, *Monarda punctata*, var. *lasiodonta*, a form with very narrow leaves. More homely and common herbs are, *Croton* ——, tall and branching, *Carlowrightia parvifolia*, *Diodia teres*, *Lippia nodiflora*, *Acalypha radians*, *Gonolobus parviflorus*.

COAST.

The vicinity of the sea does not appear to have any favorable influence on either the nature or vigor of the vegetation. From the mouth of the Rio Grande to Corpus Christi the coast is low, mostly bare, and unattractive. The trees or arborescent shrubs seen at the above town are Mezquit, mostly shrubby, extending to the very edge of the bay, Huisache and Retama, both of large size and much cultivated, Ebony (*Acacia flexicaulis*, Black Willow. Hackberry, Texas Persimmon. These trees, or some of them, with the addition of the Green Ash, the Water Elm (*Ulmus crassifolia*), Anaqua (*Ehretia elliptica*) and Nacahuite (*Cordia Boissieri*) are seen in thin fringes on many of the drains, arroyos and creeks opening into the sea.

Of the trees or shrubs introduced at Corpus Christi, the Tamarisk, 2 feet in diameter, China Tree (*Melia*), Red Mulberry, Osage Orange and Oleander are quite thrifty.

The scrubby chaparral, extending from the shore inward for several miles, consists mostly of Mezquit, Granjeno, Texas Persimmon, Junco, Coyotillo (*Karwinskia*), *Acacia amentacea* and *flexicaulis*, *Condalia obovata*, *Castela Nicholsoni*, *Xanthoxylum Pterota*, *Lippia lycioides*, *Berberis trifoliata*, *Lantana Camara*, *Aster Palmeri*.

The vines are *Anredera scandens*, *Vitis incisa*, *Serjania brachycarpa*, *Maximowiczia Lindheimeri*.

Of Grasses, the most common are Bermuda Grass (*Cynodon Dactylon*), *Aristida purpurea*, *Bouteloua Texana*, *Eragrostis reptans*, and *Eleusine Ægyptica*.

MOUNTAINS.

The principal mountain ranges of Texas are the Guadalupe, Limpio, Eagle, Chenate, and Chisos, all lying beyond the Pecos, in the western part of the State. They extend from the border of New Mexico southeastward into the Great Bend of the Rio Grande. Other elevations, with an altitude of 1,200 feet or less, also called mountains, intervene between these ranges and are also seen on the headwaters of the Brazos

and the Colorado, but their vegetation does not materially differ from that of hills and bluffs.

Guadalupe Peak, the highest in Texas, stands about 9,000 feet above the sea. Limpio Peak and the dome of the Chenates are from 500 to 800 feet lower, and lower still are the Chisos Mountains. Eagle Mountain has the least altitude, not exceeding 7,000 feet.

Good, serviceable timber is only found in the Guadalupe and Limpio Mountains. There is much arboreal vegetation in the other mountains but hardly of sufficient size for the saw-mill. Several species of Pine thrive in the Guadalupe and Limpio ranges; one species only, the Nut Pine, grows on the Chisos, and very sparingly on the north slope of the dome of the Chinates. There is none on Eagle Mountain.

GUADALUPE MOUNTAINS.

These mountains, on the south and west, are bounded by a chain of salt lakes stretching along the middle of wide alkali plains; on the contrary, their eastern base is covered with excellent grass and watered by permanent springs and brooks on which grow large Cottonwood.

They are well timbered on their broad summit (about 300 feet lower than the peak), and more or less on their eastern side, with Pine, Oak and Cedar, but the height and abruptness of the cliffs which encompass the forest would prove quite an obstacle to the removal of lumber.

The species of Pine are: Yellow Pine (*Pinus ponderosa*), the prevalent and most valuable large tree, 30 to 50 feet high and with trunk 1 to 2 feet in diameter, extending from the summit to the base of the mountain; Flexible Pine (*Pinus flexilis*), smaller than the last, with trunk seldom exceeding 1 foot in diameter, and hardly found below the summit; Nut Pine (*Pinus edulis*), a low, twisted tree straggling on the slopes; useless for lumber.

The only Fir seen here, or anywhere in Western Texas, is the *Pseudotsuga* (*Abies*) *Douglasii*, a fine tree, next in prevalence and size to the Yellow Pine.

The principal and characteristic "Cedar" of these mountains is the Thick-bark Juniper (*Juniperus pachyphlœa*), very common about Pine Spring and the only kind seen on the foot-hills. It has a short trunk, seldom 10 feet high, and from 1 to 3 feet in diameter. A smaller and rarer Juniper seen in some of the interior cañons, is *Juniperus occidentalis*, var. *conjungens*.

The Oaks are: Gray Oak (*Quercus grisea*), everywhere abundant, from a bush to a small round tree seldom a foot in diameter; Wavy Oak (*Q. undulata*), very common under two or three forms, especially the bushy var. *pungens*, near Pine Spring, and var. *Gambelii*, on the summit, a small shrub or gnarled tree 20 feet high; Chesnut Oak (*Q. Muhlenbergii*), in cañons, a rather rare but handsome tree 30 to 40 feet high.

The other trees are: The Madroña (*Arbutus Xalapensis*), common as a shrub, rare as a small tree a foot in diameter; the Red Ash (*Fraxinus

pubescens), sparingly seen as a shrub or small tree on the summit; *Fraxinus pistaciæfolia*, shrub or small tree from 10 to 30 feet high, generally near water; the Wild Mulberry (*Morus microphylla*), in cañons, mostly small, an exceptional specimen (with very small, undivided leaves), measuring 15 inches in diameter; a Maple (*Acer grandidentatum*), uncommon shrub or middle-sized tree, in cañons, also found in the Organ Mountains; *Acacia Greggii*, small tree, oftener a shrub; a Maguey (*Agave Wislizeni* *), which may be placed here, very common on the slopes but smaller than the form of the same species growing in the Chenate and Chisos Mountains.

To this list we should add, as usual, the Mesquite, Hackberry, Soapberry, Nogal, and Mexican Buckeye.

The principal and characteristic shrubs, or bushy ligneous plants, are:

On the summit:
- *Cercocarpus parvifolius.*
- *Symphoricarpus rotundifolius* and *longiflorus.*
- *Whipplea Utahensis.*
- *Ribes viscossissimum.*
- *Neillia Torreyi.*

In cañons:
- *Ptelea trifoliata.*
- *Rhamnus Purshiana.*
- *Lonicera dumosa.*
- *Fendlera rupicola.*
- *Forestiera Neo-Mexicana.*
- *Robinia Neo-Mexicana.*
- *Sophora secundiflora.*
- *Vitis riparia.*
- *Ampelopsis quinquefolia.*
- *Berberis Fremonti* and *repens.*
- *Astrophyllum dumosum.*
- *Brickellia baccharidea.*

On foot-hills:
- *Dalea formosa.*
- *Acacia constructa.*
- *Mimosa biuncifera.*
- *Ceanothus Greggii.*
- *Cercocarpus parvifolius*, var. *paucidentatus.*
- *Prunus Capuli?*
- *Spiræa cæspitosa* (crevices of rocks).
- *Garrya ovata* (first time collected in U. S.).
- *Krameria parviflora*, var. *ramossissima.*

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* Referred to this species by Dr. Engelmann. This is the Maguey found in all the mountains of Western Texas. It is allied to *A. Americana* and *A. Parryi*, but well distinguished from both.

Rhus virens and *copallina.*
Mortonia scabrella.
Chrysactinia Mexicana.
Diplopappus ericoides.
Brickellia Wrightii and *brachyphylla.*
Thymophylla Greggii.
Parthenium incanum.
Eupatorium Wrightii.
Heliomeris tenuifolia.

Of the large number of herbs observed in these mountains, the most conspicuous and characteristic are—

On foot-hills:
Nama origanifolium (on rocks, first time collected in U. S.).
Linum Berlandieri and *rigidum.*
Dalea aurea and *frutescens.*
Peteria scoparia.
Salvia chamædryoides, *farinacea* and *lanceolata.*
Seymeria scabra.
Pentstemon barbatus, var. *Torreyi.*
Sphæralcea Fendleri and var. *dissecta.*
Erysimum asperum.
Menodora longiflora and *heterophylla.*
Phlox nana.

On the summit and upper slopes:
Silene laciniata, var. *Greggii.*
Frasera speciosa.
Geranium cæspitosum.
Campanula rotundifolia (with white flowers).
Gilia aggregata, *rigidula* (and var. *acerosa*).
Erysimum ——.

In cañons:
Linum Greggii.
Ipomœa Lindheimeri, *coccinea* (var. *hederifolia*), *Mexicana.*
Maurandia Wislizeni.
Mirabilis multiflora.

Composites (herbaceous):
Artemisia Ludoviciana and *dracunculoides.*
Liatris punctata.
Baccharis Havardi (Gray, n. sp.).
Riddellia tagetina.
Hymenatherum acerosum and *tenuifolium.*
Gallardia pinnatifida.
Leucampyx Newberryi (on summit).
Berlandiera lyrata.
Engelmannia pinnatifida.
Thelesperma longipes and *gracile.*

Aplopappus spinulosus, blephariphyllus, rubiginosus.
Chrysopsis villosa (vars. *canescens* and *foliosa*).
Actinella scaposa (var. *linearis*) and *linearifolia.*
Bidens Bigelovii.
Senecio longilobus.
Aster multiflorus.
Helianthus petiolaris and *lenticularis.*

Grasses:

Bouteloua oligostachya, racemosa (var. *aristosa*), *eriopoda.*
Andropogon saccharoides and *furcatus.*
Muhlenbergia Texana, pauciflora, arenicola, setifolia (Vasey, n. sp).
Hilaria mutica.
Pappophorum Wrightii.
Triodia acuminata.
Sporobolus asperifolius.
Eragrostis tenuis and *capillaris.*
Setaria caudata.
Aristida dispersa and *purpurea.*

About 3 miles northeast of Pine Spring is a small valley down which runs Five Spring Creek, and containing large Cottonwood and Chestnut Oak. A giant Sunflower (*Helianthus grosse-serratus*), a large flowered form of *Œnothera biennis* and the Water-Hemlock (*Cicuta maculata*) thrive in the marshy ground, mixed with Cat-tail (*Typha latifolia*) and Wild Broom Corn (*Phragmites communis*). A few miles further is another pretty brook (Marr's Creek), shaded with Ash (*Fraxinus pistaciæfolia*) and Black willow. The grazing is excellent in the foot-hills. At Grapevine Creek there is hardly any timber, but the grass continues fine.

Snake Spring, a large body of slightly saline water, issues from the ground about 2 miles from the base of the mountain. The grazing in its immediate vicinity is poor, but the possibility of irrigation permits the raising of corn and vegetables. The country improves and fine rolling prairies are passed on the way north to Brigg's Ranch. Black River, where the road strikes it, is dry and timberless. Brigg's Creek, a permanent, salt-water stream, has its source in the foot-hills under a bower of Hackberry, Soapberry, and Sumac (*Rhus copallina*).

The mountain, here, is hardly more than a high table-land, gradually sloping northward to the level of the plain. It is bare of arborescent vegetation, and mostly covered with the exceedingly noisome Lechuguilla. The leaves of this *Agave* change very little, but the variations of its fruiting stem—from a stalk the thickness of the little finger, and 3 to 5 feet high, bearing few sessile, geminate pods, to a stalk 1½ inches thick and 10 feet high, bearing an ample pyramidal panicle 4 feet long—are puzzling and interesting.

A foot-trail, up Rattlesnake Cañon and over a rocky divide, led us into Guadalupe Cañon, a picturesque mountain valley in the heart of the range, fairly timbered with Chestnut Oak and Gray Oak, Cottonwood,

Juniper, Maple, Madroña, Choke-cherry, Mulberry, Willow, Shrubby Trefoil, &c. The Arroyo Grape (*Vitis riparia*) is abundant in places. About 8 miles above the point where the trail joins the cañon, Pine timber begins, and is thereafter quite common southward. Near its head the cañon spreads out and discloses vast grassy slopes covered with fine groves of large Gray Oak.

On old trails are found mescal pits where the Indians used to bake the bulbous bases of the *Agave Wislizeni*, the common Maguey of these mountains.

FROM THE GUADALUPE MOUNTAINS TO EL PASO.

West of the Guadalupe Range, on the El Paso road, are small, isolated mountains: The Cornudas, irregular agglomerations of huge volcanic boulders; Wind, Alamo, and, farther west, Hueco Mountains, all containing, in the shelter of cañons, a fair growth of small timber, consisting principally of Gray Oak (*Quercus grisea*), under several interesting forms which seem to connect it with *Q. Emoryi*, and Red Cedar (*Juniperus occidentalis*), the latter bearing a peculiar pink-berried Mistletoe (*Phoradendron Bolleanum*). On the southwest slope of Alamo Mountain is a seeping spring around which stands a conspicuous grove of Cottonwood; it might prove interesting to speculate upon the manner of introduction of this tree at this remotely isolated point.

From the Cornudas to the Hueco Mountains, the luxuriant grass (mostly Gramas) could hardly be excelled in quantity and quality; unfortunately, water is almost entirely absent.

LIMPIO MOUNTAINS.

These mountains consist of several ranges extending north and west from Fort Davis for many miles. Several of their summits and slopes are finely timbered, while the main valleys are watered by clear, swift brooks emptying into the Limpio. Northeast of Limpio Peak is the "Pinery," where a Government saw-mill has been in operation for several years.

The timber trees are: Yellow Pine (*Pinus ponderosa*), most prevalent, yielding clear lumber 18 inches wide; Flexible Pine (*Pinus flexilis*), of about the same size but not so common; Nut Pine (*Pinus edulis*), plentiful on lower ridges and in valleys, often large enough to be sawn but making inferior lumber; Thick-bark Juniper (*Juniperus pachyphlœa*), the only kind seen in the Pine district.

Along the branches of the Limpio, grow: A shrubby Oak (*Quercus hypoleuca*), not before observed outside of Arizona; a somewhat larger kind, *Quercus rubra*, var. *Texana*, and scattered specimens of Texas Green Ash. The horridly spinose *Adolphia infesta* is abundant on interior foot-hills, and the hardly less obnoxious *Ceanothus Fendleri* hedges many arroyos. A new *Astragalus* (*A. giganteus*, Watson), remarkable for its size, was collected near the base of Limpio Peak.

Fort Davis stands under the Limpio Mountains, at an altitude of

4,700 feet. Common here and in the foot-hills are the small Gray Oak and Emory's Oak (*Quercus Emoryi*). The latter is larger than the preceding and of more elegant port and foliage. On the El Paso road, where it skirts the southern base of the mountains, this stately Oak becomes the main feature of the sylva; its straight trunk is from 2 to 4 feet in diameter while the dark mass of shining foliage reaches the height of 60 feet. Here, also, the Nut Pine attains the unusual size of 18 inches in diameter and 40 feet in height.

In cañons near the Post, and on surrounding cliffs, are found: Frijolillo (*Sophora secundiflora*), Cedar (*Juniperus occidentalis*), Choke-Cherry (*Prunus Capuli?*), small tree 10 to 15 feet high; Madroña, small and uncommon; *Philadelphus serpyllifolius*, *Fendlera rupicola*, Sumachs (*Rhus microphylla* and *trilobata*), Wild Mulberry, and several suffruticose species of *Croton*. The Leguminous shrubs *Acacia Greggii* and *Mimosa biuncifera* are also prominent.

The Desert Willow (*Chilopsis saligna*) grows on the parade-ground.

Of the lignescent or herbaceous plants at and about Fort Davis the following are the most conspicuous:

Acacia filicina.
Bouvardia hirtella.
Tecoma stans.
Nolina erumpens.
Lithospermum multiflorum and *Cobrense.*
Cucurbita perennis.
Apodanthera undulata.
Houstonia angustifolia.
Pentstemon barbatus, *Fendleri*, *glaber* (var. *cyananthus*).
Castilleia integra and *lanata.*
Mimulus Jamesii, var. *Texensis.*
Œnothera speciosa, *triloba*, *tubicola*, *primiveris*, *pinnatifida.*
Gaura sinuata and *macrocarpa.*
Mentzelia Wrightii.
Asclepias tuberosa, *verticillata*, *longicornu*, *Jamesii*, *nummularia*, *perennis.*
Philibertia linearis.
Gonolobus reticulatus and *productus.*
Oxalis Wrightii.
Boerhaavia scandens and *Grahami.*
Phlox nana.
Phacelia glandulosa.
Astragalus Nuttallianus and *mollissismus.*
Dalea rubescens, *aurea*, *pogonathera.*
Phaseolus macropoides.
Cologania longifolia.
Linum multicaule and *perenne.*
Verbena bipinnatifida and *ciliata.*
Thamnosma Texanum.

FROM SIERRA BLANCA TO THE CHENATE MOUNTAINS.

Near the junction of the Texas Pacific with the Southern Pacific Railroads, is Sierra Blanca, so called from its whitish, barren aspect. It bears no other arborescent growth than a bushy form of Gray Oak and scrub Cedar. The Quitman Mountains, to the southwest, show dark fringes of the same small timber among their craggy outlines.

Eagle Mountain rises in successive grassy inclines to its conical summit, about 2,000 feet above the plain. It contains a considerable growth of Gray Oak and Red Cedar, but of too small size to make serviceable lumber. The best of the Oak, in cañons at the base, have a straight trunk 12 to 15 feet high and 1 foot in diameter. The Cedar is of two species: *Juniperus occidentalis* on foot-hills, and higher up, *J. pachyphlœa*, already noticed as the prevalent Juniper of the Guadalupe and Limpio Mountains, but here much smaller. Choke-Cherry trees (*Prunus Capuli?*) of good size were seen in a basin between foot-hills, and, close by, a few specimens of *Berberis Fremonti*, an elegant shrub 10 to 12 feet high. *Cercocarpus parvifolius*, var. *paucidentatus*, and the obnoxious *Adolphia infesta* are common on foot-hills. In the shade of rocks, near the summit, *Heuchera rubescens* grows abundantly. Lower down are tufts of a large form of *Artemisia frigida*, contrasting with the showy panicles of *Gilia aggregata*.

Eagle Spring, at the northern base of the mountain, is a shallow hole in a bare, gravelly bank. Between it and Quitman Cañon, along the foot-hills, are large groves of Palmo (*Yucca baccata*, var. *australis*) 15 to 30 feet high.

Continuous with Eagle Mountain and running southeastward are several minor ranges, viz., Van Horn, Vieja, and Capote Mountains, which contain, in cañons, a small amount of timber consisting of the usual Gray Oak and Red Cedar, to which is added *Quercus Emoryi*, here of medium size. These mountains are precipitous on the river side but slope gradually to the north and east, merging in the vast prairie district extending thence to Fort Davis.

CHENATE MOUNTAINS.

These mountains, only second in altitude to the Guadalupe, are somewhat parallel with, and about 20 miles from, the Rio Grande.

There is no Pine on the two lower peaks nor on the summit or dome, but thin clumps of Nut Pine are found on the northern face of the latter. The timber of these mountains consists of Red Cedar, seldom of useful size, and Gray Oak, short stemmed and round headed, rarely a foot in diameter. Groves of this Oak fill ravines and creep up the mountain sides in dark, sinuous lines. The large timber in Cibolo Cañon has already been described.

Of the shrubbery should be noted:

Prosopis juliflora.

Acacia constricta and *Greggii.*

Mimosa Lindheimeri, borealis, biuncifera.
Dalea formosa.
Coldenia Greggii and *canescens.*
Celtis pallida.
Microrhamnus ericoides.
Lippia Wrightii, lycioides, graveolens.
Salvia Greggii.
Lonicera dumosa.
Anisacanthus Thurberi.
Leucophyllum Texanum and *minus.*
Berberis trifoliata.
Buddleia marrubiifolia.
Mortonia scabrella.
Dicrourus diffusus.
Krameria canescens, parvifolia, and var. *ramossissima.*
Flourensia cernua.

Nolina Texana, *Yucca baccata* and Sotol are common. Lechuguilla, a form with low, slender stems and geminate flowers, besets the hillsides; higher up is the large Maguey (*Agave Wislizeni*) already noticed in the Guadalupe and Limpio Mountains, here with stout stalks 15 to 18 feet high.

Of the flowering herbs the most characteristic are:

Aquilegia chrysantha.
Mirabilis Wrightii.
Boerhaavia paniculata and *erecta.*
Nicotiana trigonophylla.
Linum rigidum and *rupestre.*
Menodora scabra, pubens, longiflora.
Abutilon Wrightii and *crispum.*
Anoda cristata.
Pavonia Wrightii.
Œnothera pinnatifida, tubicola, Greggii.
Gaura coccinea and *sinuata.*
Phacelia congesta and *integrifolia.*
Dalea frutescens, Wrightii, lachnostachys, aurea, mollis, rubescens.
Hosackia puberula.
Indigofera Lindheimeriana.
Desmanthus velutinus.
Rhynchosia Texana.
Galium Wrightii.
Eriogonum Abertianum, annuum, rotundifolium, Havardi.
Thamnosma Texanum.

BOFECILLOS MOUNTAINS.

About 15 miles below Presidio del Norte, begins the high, grassy plateau of the Bofecillos, drained, as already seen, by Ternero and Grape-

vine Creeks. Into these, and the Rio Grande, empty many cañons and ravines containing more or less Hackberry, Willow, Nogal (*Juglans rupestris*), Buckeye (*Ungnadia speciosa*), Sumac (*Rhus copallina* and *virens*), and Mulberry (*Morus microphylla*); sometimes, Cottonwood and Texas Green Ash, shading springs. The uplands bear scattered clumps of Cedar and Gray Oak. These general remarks apply to the range of smooth, grassy bluffs extending to Los Alamos de Cesario Creek; thence to Agua Fria, the country is more rocky and barren.

CHISOS MOUNTAINS.

The Great Bend of the Rio Grande, extending from the Tarlinga on the west, to the Maravillas on the east, is, with the exception of parts of the Staked Plains, the most sterile and unattractive region of West Texas. The Rossillo Mountains are the best part of it and the only one where the grazing of large herds is at all possible. They are covered from base to summit with fine grass in ordinary seasons, and have four or five permanent springs, two or three of which are shaded with Cottonwood.

The Chisos Mountains are very imposing from their height and bulk. They contain a fair amount of small timber and their valleys and slopes are lined with good grass, but, owing apparently to their geological formation, are so destitute of permanent water as to preclude their settlement by stockmen. The broad plains surrounding them are barren and dreary in the extreme.

The only Pine on the Chisos is the Nut Pine (*Pinus edulis*) which covers the summits and many of the upper slopes; it is often a foot in diameter and 40 feet high. With it are two species of Cedar, shrubs or small trees, *Juniperus occidentalis* and *J. flaccida*, the latter not before observed north of the Rio Grande.

In valleys, the Texas Red Oak (*Quercus rubra*, var. *Texana*), a medium tree, is the prevalent kind. Gray Oak (*Q. grisea*), of small size, is common on foot-hills. *Quercus Emoryi*, of medium size, occupies almost exclusively several of the cañons. More rare is *Q. Durandii.*

Other trees seen in high cañons, but uncommon, are: a Maple (*Acer grandidentatum*), also growing in the Guadalupe and Organ Mountains; a Cherry-tree (*Prunus Capuli*), both of medium size; and an Ash (*Fraxinus cuspidata*) somewhat smaller.

Of shrubs the following are sparingly found:

Cercis reniformis.
Sophora secundiflora.
Arbutus Xalapensis.
Sambucus Canadensis.
Rhamnus serrulata (new to the United States).
Spiræa discolor.

More common and characteristic are the following:

On slopes:

Prosopis juliflora.
Zizyphus obtusifolius.
Cercocarpus parvifolius.
Rhus virens, microphylla, trilobata.
Forestiera angustifolia.
Lippia Wrightii.
Bouvardia hirtella.
Houstonia fasciculata.
Dalea formosa.
Calliandra conferta.
Acacia Rœmeriana, Greggii, constricta, filicina.
Porliera angustifolia.
Bernardia myricæfolia.
Salvia chamædryoides and *Regla* (new to the United States).
Philadelphus microphyllus.
Berberis Fremontii.

In valleys:

Garrya ovata.
Rhamnus Purshiana.
Kœberlinia spinosa.
Prunus minutiflora.
Morus microphylla.
Diospyros Texana.
Condalia Mexicana and *spathulata.*
Mimosa biuncifera.
Ungnadia speciosa.
Sapindus marginatus.

Abundant are Lechuguilla, Maguey, and Sotol. The former (*Agave heteracantha*) infests the foot-hills, and, in places, extends up high slopes where it mingles with the latter (*Dasylirion Texanum*). The Maguey (*Agave Wislizeni*), already noticed in other mountains, thrives in high altitudes, even on the very summit. Its stem is from 3 to 5 inches in thickness, 13 to 18 feet high, and bears from eight to sixteen panicles.

To these plants should be added the usual *Yucca baccata* and *angustifolia, Nolina erumpens* and *Texana*, and the bushy Composites: *Hymenatherum acerosum, Zexmenia brevifolia, Trixis angustifolia.*

Of the Cactacæ the most prominent representative is the noted Strawberry Cactus (*Cereus stramineus*), with large, luscious fruit.

Of the many lignescent or herbaceous plants which characterize these mountains, the following are most conspicuous:

Carlowrightia linearifolia, common in arroyos.
Pentstemon barbatus, Eatoni, Havardi.

Castilleia integra.
Seymeria scabra.
Stachys Bigelovii, shade of rock near summit.
Poliomintha mollis.
Cedronella micrantha and *pallida* (var. *parviflora*).
Silene laciniata var. *Greggii*, upper slopes.
Aquilegia longissima (new to the United States), upper cañons.
Desmanthus velutinus.
Hosackia puberula.
Dalea frutescens.
Oxybaphus aggregatus, upper shady slopes.
Tradescantia leiandra, shade of rock.
Talinum parviflorum, shade of rock.
Sedum Liebmannianum (new to the United States), shade of rock.
Cotyledon strictiflora, sides of rocky cañons.
Hibiscus Coulteri, common on gravelly foot-hills.
Heuchera rubescens, upper shady slopes.
Spiranthes cinnabarina (new to the United States), only one specimen seen on rocky foot-hill.
Evolvulus alsinoides.
Asclepias perennis, var. *parvula.*
Gilia aggregata and *incisa.*
Phacelia congesta and *integrifolia.*
Linum perenne, *Greggii*, *multicaule.*
Eriogonum tenellum on hills, and *Wrightii* in cañons.
Thelypodium lincarifolium.
Galium microphyllum.

Grasses:

Stipa tenuissima.
Lycurus phleoides.
Melica mutica, var. *glabra.*
Bromus ciliatus, var. *minor.*
Stipa fimbriata.
Cathestechum erectum.
Muhlenbergia distichophylla.

In arroyos, at the northern base of the mountains, the handsome *Anisacanthus pumilus* is common, and a new species, *Nama Havardi*, (Gray), stout and erect, was collected.

SALT LAKES BASIN.

This barren and desolate tract of alkali land begins at the western base of the Guadalupe Mountains, above Crow Spring, and extends in a south-southeast direction to Rattlesnake Spring, having Sierras Prieta and Diablo to the west, and to the east the Guadalupe Mount-

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ains and Sierra Pesuño de Caballo. It may be described as a sandy basin, about 50 miles long and from 15 to 20 miles wide, through the center of which stretches a chain of salt lakes, some not larger than ponds, others several miles long. The water is clear but quite brackish, and seldom drinkable even for animals. In a few places, however, near the edge of some of the lakes, springs are found with good water. Large deposits of chloride of sodium occur in places. Between Crow Spring and Guadalupe Peak, is a range of white sand-hills whose shifting, glistening surface is delicately undulated by the wind.

The smooth, broad beach of the lakes, more or less incrusted with alkali, is absolutely bare. Here and there, low sand hillocks are covered with *Spirostachys occidentalis*, *Larrea Mexicana*, and *Frankenia Jamesii.* Along the edge of the basin, the broken, gravelly ridges bear a fair amount of Grama, and afford refuge to the narrow-leaved Yucca, Bear-Grass, and Maguey (*Agave Wislizeni*).

Crow Spring, an appropriate name, suggestive of the only bird inhabiting this region, lies near the northern extremity of the basin, on the road to El Paso. The only ligneous vegetation visible here is a thicket of *Forestiera Neo-Mexicana.* The water is brackish and the grass salt, the latter consisting mostly of *Sporobolus airoides* and *Wrightii.*

PART II.

ECONOMIC NOTES ON THE TEXANO-MEXICAN FLORA.

The plants herein noticed are grouped together in their natural botanical orders and genera, while the orders succeed one another somewhat as convenience and usefulness suggested.

LEGUMINOSÆ.

Prosopis juliflora, DC. (*Algarobia glandulosa*). (Mezquit.) *

This tree constitutes the principal growth of the wooded table-lands and high valleys throughout South and Southwestern Texas. The trunk is seldom over a foot in diameter and generally too crooked and knotty to make serviceable lumber. Mezquit posts and rails, much used in fencing, are but slightly affected by exposure to ordinary weather influences, and if care be taken to strip off the bark so that the eggs of the Mez-

* The correct spelling of this Mexican name is Mezquite, with the accent on the penultimate. North of the Rio Grande the final e is generally omitted, but the accent should remain the same and the word be pronounced as if written 'Mezkeet'.

For fuller details see American Naturalist for May, 1884.

quit larva, a destructive borer, may not be laid in it, they will easily last a century.

Mezquit makes excellent hedges; as it grows readily, a vigorous shrub, on high plains where no other large spinose shrub will thrive, its value in this respect can hardly be overestimated. Seedlings are easily raised, and if transplanted in prepared ground wherever needed, during the rainy season, they should, in 3 or 4 years, develop into strong shoots which by proper pruning and trimming will form impenetrable hedges.

Wood very hard, heavy, fine-grained, taking a beautiful polish; it is also richly colored, its several zones varying from purple in the center to red and yellow towards the circumference. These qualities render it valuable for cabinet-work; unfortunately it too often happens that the zones of the heart-wood are cracked so that it is somewhat difficult to get flawless boards.

The heart-wood, stem and root, contains tannin in the proportion of 6 to 7 per cent. The bark and external white wood contain less than 1 per cent, and the leaves are entirely destitute of it. It yet remains to be ascertained, by practical test, whether the heart-wood can be used profitably by the tanner. Infusions and decoctions of it will be found useful in the Great American Desert, in default of other medicines, to purify water, prevent scurvy, or check dysentery.

In several Texas towns, pavement blocks of Mezquit are extensively used and have been found to answer the purpose excellently well.

As fuel, the wood from both root and stem is unsurpassed. It is the most commonly used from San Antonio, Tex., to San Diego, Cal., and often the only kind obtainable. According to Dr. Loew, the charcoal made from it is of the best quality for metallurgical and smelting purposes.

During the summer months the bark secretes an amber-colored gum which has the taste of gum arabic and, like it, makes excellent adhesive mucilage. Its solution in water is slightly acid and astringent; it is a useful and palatable drink in the diarrhea of children. The quantity of gum secreted by each tree is not large enough to make it an important article of commerce.

The ripe pod, or "bean," with thick and spongy mesocarp, contains more than half its weight of assimilable nutritive principles and is therefore a valuable article of food; the most important of these is sugar, in the proportion of 25 to 30 per cent. Most herbivorous animals, but especially the horse and the mule, are fond of this pod and thrive on it. In the field, it is a welcome though imperfect substitute for grain.

The Mezquit "bean" is one of the staple foods of Mexicans and Indians. They grind it on the "matate" and, after removing shell and seeds, boil the flour in water. The infusion of this flour can easily be made to undergo alcoholic fermentation whereby a weak beer is obtained, formerly much used by Comanche and Apache Indians.

Prosopis pubescens, Benth. (Screw Bean; Tornillo.)

Low, neat shrub, growing luxuriantly along the Rio Grande and many of its tributaries from El Paso to Devil's River. Its straight and long stems are useful for building huts, and fencing. It is also an effective hedge-plant on bottom-lands. The wood is not near as hard as that of Mezquit but makes good fuel.

The twisted pod, or "bean," contains a spongy and nutritious pulp rich in sugar, and is used as food by Mexicans and Indians. Herbivorous animals are very fond of it. Its smallness, however, and the stony hardness of the seeds render it less valuable than that of the Mezquit.

Acacia flexicaulis, Benth. (Mexican Ebony.)

Shrub, or small round-headed tree, with handsome evergreen foliage, common on the bluffs of the Lower Rio Grande and the Gulf Coast. Its straight trunk is seldom over a foot in diameter. Wood heavy and compact, with the several shades of ebony and taking nearly as fine a polish, hence its great value to cabinet-makers. As fuel it is even considered superior to that of Mezquit. Ebony posts are reputed the most durable of any made from Texas woods and may be said to last forever.

The thick, woody pods, 4 to 6 inches long, contain round seeds the size of peas, which, if boiled while still green, are quite palatable and nutritious. When ripe and dry they are toasted by the natives and the black outer skin, or testa, used as a substitute for coffee.

The flowers, in cream-colored catkins, exhale a very delicate fragrance.

Acacia Farnesiana, Willd. (Huisache.)

Spreading, round-headed, ornamental tree, with evergreen (in mild winters) and beautiful foliage; common at San Antonio and thence to the Lower Rio Grande and the Gulf Coast. Trunk seldom over a foot in diameter. The rose-colored wood is hard and compact, excellent for cabinet-work; probably contains tannin; makes very good fuel. Huisache posts rank next to those of Mezquit in durability.

The yellow, capitate flowers, which appear in great profusion during February and March, are very fragrant and would probably yield a rich essential oil.

A decoction of the pod contains tannin, and is used by Mexicans who mix it with an iron salt to make writing ink.

Acacia Greggii, Gray.

Mere straggling shrub above Laredo, becoming a small, slender tree 35 feet high, with stem 8 to 10 inches thick, on the Lower Rio Grande where it is called Uña de Gato. Forms most intricate spinose thickets on many gravelly bluffs where it would make excellent hedges. Wood exceedingly hard, close-grained and heavy.

Acacia Wrightii, Benth.

Often found west and south of San Antonio as a small, round tree, with stem 6 to 8 inches thick. Wood very hard.

Acacia Rœmeriana, Schlecht.

Stout shrub, common in Western Texas, with foliage much like that of the preceding. Good hedge-plant.

Acacia Berlandieri, Benth., and **A. amentacea**, DC.

The former covering the arid bluffs of the Lower Rio Grande, the latter extending farther north and west, being common at San Antonio; both excellent hedge-shrubs, especially the *amentacea*, with its strong, stiff, prickly branches; unfortunately its seeds seldom develop and ripen; the *A. Berlandieri*, on the contrary, is very fructiferous.

Mimosa biuncifera, Benth., and **M. borealis**, Gray. (Uña de Gato.)

Common bushes west of the Pecos, on dry gravelly soil, noted for the abundance and stoutness of their prickles; possible hedge-plants.

Pithecolobium brevifolium, Benth. (Huajillo.)

Shrub on the Lower Rio Grande, with permanent foliage readily eaten by sheep and goats in winter.

Sesbania Cavanillesii, Watson.

Very graceful shrub or small tree on the Lower Rio Grande, with showy racemes of bright yellow flowers in August, and winged legume. Seeds used as a substitute for coffee.

Sophora secundiflora, Lag. (Frijolillo; Coral Bean.)

Stout ornamental shrub, with deep green foliage, common from the Gulf Coast to the Pecos; thence smaller and less frequent, but found in mountain cañons as far west as El Paso. Only a shrub on the Lower Rio Grande, but described by Lindheimer as a small tree, 30 feet high, on the shores of Matagorda Bay. The showy bunches of violet flowers give off a strong, nauseating and very offensive smell. Wood yellow, hard and heavy, dyeing yellow.

The pod holds 3 or 4 round, red beans, the size of small marbles, and very poisonous. They contain an alkaloid, sophoria, isolated by Dr. H. C. Wood in 1877. It is a whitish, amorphous substance, with strong narcotic properties and capable of producing convulsions, temporary loss of voluntary movement and distressing vomiting. According to Dr. Rothrock (who quotes Mr. Bellanger, of Texas, as his informant) "The Indians near San Antonio used this bean as an intoxicant, half a bean producing delirious exhilaration followed by a sleep which lasts 2 or 3 days, and it is asserted that a whole bean would kill a man."

Sophora affinis, T. & G.

Small ornamental tree, 10 to 15 feet high, with stem 4 to 8 inches in diameter. At San Antonio and sparingly in Southern and Eastern Texas. Wood yellow and very heavy.

Parkinsonia aculeata, L. (Retama.)

San Antonio, Lower Rio Grande, Gulf Coast and Southeastern Texas. Very handsome tree, small or medium-sized, often cultivated for ornament. "According to Mr. Schott, it is valued by the Mexican Indians as a febrifuge and sudorific, and also as a remedy in epilepsy." Mexican women use an infusion of the leaves to induce abortion. Wood hard, making good fuel.

Parkinsonia Texana, Watson.

Bluffs of the Lower Rio Grande. Small spinose shrub, with golden blossoms, deserving introduction as one of the prettiest of ornamental plants. Burned in the green state, the branches yield ashes rich in alkali, and used by Mexicans to make soap.

Phaseolus retusus, Benth. (Prairie Bean.)

Common on prairies west of the Pecos, its creeping stems often 15 to 20 feet long. The seeds (3 to 5 in each pod) are about the size of peas; when still green and well cooked they make an acceptable dish in the field. When ripe they are too tough for use.

Psoralea esculenta, Pursh. (Pomme Blanche.)

Small herb, very common on the prairies of the Northwest, but very sparingly found in Western Texas. Its esculent tuberous roots are nutritive, wholesome and pleasant to the taste.

Hoffmanseggia stricta, Benth. (Camote del Raton.)

Very pretty herb found in all valleys, with an esculent tuberous rootstock.

Peteria scoparia, Gray. (Camote del Monte.)

Stout, spiny, suffruticose herb, found sparingly in the foot-hills of the mountains west of the Pecos, also with a small, edible, tuberous rootstock.

Astragalus mollissimus, Torr.

Probably not specifically distinct from *A. Bigelovii*, Gray. The best known "loco" plant of Western Texas. Rather common on high prairies and mesas west of the Pecos, specially abundant about Peña Colorado and Fort Davis. Perennial plant, 6 to 10 inches high, with pinnate leaves quite silky, and rather conspicuous racemes of purple flowers in the early summer.

Animals, even goats, avoid this plant which has a very nauseous smell (much intensified by drying), and only eat it through inadvertence or necessity. Horses and cattle are similarly affected by it. They lose their appetite, become stupid, with spells of vicious exhilaration, grow thin, have tremors of the muscles, lose power to co-ordinate movements and estimate distances so that locomotion is rendered awkward and dangerous and finally becomes impossible. Horses may

even have blind-staggers. It is said that animals having once felt the effects of this weed are very likely to return to it until it kills them.

Oxytropis Lamberti, Pursh.

Herb, in habit bearing some resemblance to the preceding, only found in Northern Texas and nowhere common in the State. It is a loco plant of bad repute which, however, it may not deserve.

SALICACEÆ.

Populus monilifera, Ait. and **P. Fremonti**, Watson. (Cottonwood; the Alamo of the Mexicans.)

Species closely allied and hard to distinguish; the latter not extending east of the Pecos. Abundant on the Rio Grande, from El Paso to Presidio del Norte; common on the San Antonio and Medina Rivers, scant on the Nueces; also found on the headwaters of the many forks of the Colorado, Brazos and Red River where they indent the high plateau of the Staked Plains, and along water-courses at the base of the Guadalupe, Limpio, and Chenate Mountains.

In all of these places the Cottonwood reaches a large size, 1 to 5 feet in diameter, and is a valuable timber and lumber tree. If protected from rain and sun the wood is very durable; it possesses remarkable immunity from boring larvæ. I have seen beams of it quite sound in churches more than a century old. Boards, unless carefully dried, are liable to warp and crack; this is prevented by boiling in lye. Cottonwood makes poor fuel.

Salix nigra, Marsh. (Black Willow; Sauz of the Mexicans.)

Under several forms, the commonest species of Willow; grows on most streams as a small or medium-sized tree. On the Lower Rio Grande, where it is sometimes absurdly called Cottonwood, it attains a large size, 1 to 3 feet in diameter, and becomes an important timber tree.

Salix longifolia, Muhl. (Long-leafed Willow.)

Like the preceding, very common along water-courses, varying much in size from a small shrub along the Middle Pecos to a medium-sized tree in the Chenate Mountains.

Salix amygdaloides, Anders. ?

Good-sized tree, common on the Rio Grande from El Paso to old Fort Quitman.

The wood of these willows is tolerably hard and tough, but not very durable, and only makes passable fuel. The Mexicans scrape off the leaves, crush and make an infusion of them which is used internally and externally in yellow fever and other fevers of malarial origin. If there be any efficacy in the leaves thus used it seems as though there ought to be more in the bark.

The leaves of the Texas Fresno (*Fraxinus viridis*, var. *Berlandieriana*) are also used for the same purpose.

CONIFERÆ.

Pine timber is restricted to the Guadalupe, Limpio, Chisos, and Organ Mountains. No attempt has as yet been made to utilize it in the somewhat inaccessible Guadalupe and Chisos Mountains, while saw-mills have been in operation at several "pineries" in the Limpio Mountains.

Pinus ponderosa, Dougl. (Yellow Pine.)

The prevalent and most valuable Pine of the Guadalupe and Limpio Mountains; trunk 1 to 2 feet in diameter; hard, heavy, durable wood, making excellent lumber and very good fuel.

Pinus flexilis, James. (White Pine.)

In the Guadalupe and Limpio Mountains; a smaller tree than the preceding, and also inferior to it in the quality of its wood.

Pinus edulis, Engelm. (Piñon; Nut Pine.)

Common in the Guadalupe, Limpio, Organ, and Chisos Mountains; also found on the higher ridges and bluffs of the Great Bend of the Rio Grande as far north as the Southern Pacific Railroad, on the forks of the Nueces River and along the edges of the high plateau of the Staked Plains. In the Chisos Mountains, which it occupies exclusively, it becomes a tree with straight trunk 1 foot in diameter and could be sawn into useful lumber of very fair quality. It reaches about the same proportions in the Limpio and Organ Mountains. Elsewhere it is seldom large enough for anything but fuel and fence rails.

The Piñon bears small globose-ovate cones containing a few roundish, wingless seeds; these consist of a thin, fragile shell inclosing an edible kernel which is eaten raw or roasted.

Pseudotsuga (Abies) Douglasii, Carrière. (Douglas' Spruce.)

On the Guadalupe Mountains, the only Fir in Western Texas; a large tree, next in prevalence, size and quality to the Yellow Pine in those mountains.

Juniperus occidentalis, Hook. (Western Red Cedar.)

Very common shrub or stunted tree on the mountains, foot-hills, high ridges, and many of the bluffs of Western and Southern Texas; only fit for fencing and fuel. The variety *conjungens*, common on the Nueces and north of San Antonio, is quite rare west of the Pecos.

Juniperus pachyphlœa, Torr. (Thick-bark Juniper.)

Found in moderate abundance in the Guadalupe, Limpio, and Eagle Mountains. A larger tree than the preceding; trunk, 1 to 2 or more feet in diameter, but seldom more than 10 feet high. It is probably this tree which near Santa Fé, according to Dr. Loew, furnishes, by tapping the lower part of the trunk, a yellow, aromatic, transparent balsam used in various urinary disorders. Wood reddish, close-grained,

very hard and durable. Berries greenish, or at last becoming purplish, globose, half an inch in diameter, with sweetish and palatable pulp.

Juniperus flaccida, Schlecht.

Small tree, only seen in the Chisos Mountains.

Taxodium distichum, Richard. (Bald Cypress; the Sabino of the Mexicans.)

Large, valuable tree, growing sparingly on the San Antonio River and some few other streams between it and Devil's River; also at scattered points on the Lower Rio Grande.

Ephedra antisyphilitica, C. A. Meyer, and **E. trifurca**, Torr. (Cañatilla; Tepopote.)

Shrubs, 2 to 4 feet high, with long, slender, greenish branches, the leaves reduced to short bracts which are opposite in the first, and in threes in the second species. They are exactly alike in habit and mode of growth, and may be only forms of the same species. These shrubs are hardly ever absent from the gravelly mesas and bluffs of Western and Southern Texas. They are popular remedies among Mexicans and frontiersmen in the treatment of syphilis and gonorrhœa, especially the latter. The decoction or infusion of the stems has an acid reaction and an astringent taste resembling that of tannin. It is used as an injection and internally; some caution should be observed as it has been known to cause strangury. Dr. Rothrock [Botany West of the 100th Meridian], summing up Dr. Loew's analysis of *E. antisyphilitica*, says:

"The filtrate of the aqueous solution proved the presence of tannin and tartaric acid. Pectin was also shown to be in the filtrate by the jelly-like precipitate produced by the addition of alcohol. The tannin belongs to the glucosid group, furnishing sugar on treatment with acids and various other compounds, and, upon dry distillation, pyrogallic and carbonic acids. This tannin splits up into sugar and a red amorphous powder. The powder, Dr. Loew considers quite a distinct body which he names ephedrin, and to this he attributes (probably correctly) the remedial properties of the plant."

CUPULIFERÆ.

Quercus virens, Ait. (Live Oak.)

Common along most water-courses from San Antonio to Eagle Pass and Devil's River; hardly extends beyond the Pecos. Tree of vigorous growth, with thick but short trunk; wood invaluable as timber or fuel.

Quercus grisea, Liebm. (Gray Oak.)

The most abundant, I may say the characteristic, Oak of Western Texas. Found west of the Pecos in all mountain cañons and on most foot-hills, high ridges, and bluffs. It is a small tree, seldom more than a foot thick, but its heavy, compact, tough and exceedingly hard wood could be used advantageously. The cross-section is remarkable for the

conspicuousness of its medullary rays, causing, in polished boards, beautiful effects of silver-grain.

Quercus rubra, var. **Texana**, Buckley. (Texas Red Oak.)

Good-sized tree at San Antonio, smaller westward and very sparsely scattered in hilly districts from San Antonio to the Limpio Mountains.

Quercus Emoryi, Torr. (Emory's Oak.)

Abundant in some of the cañons and along the southern base of the Limpio Mountains; forms the exclusive arboreal growth of some of the cañons of the Chisos Mountains. In the former habitat it is a handsome tree, with tall and straight stem 1 to 3 feet in diameter; in the Chisos Mountains it seldom exceeds 15 inches. Wood hard and valuable as timber and fuel.

Quercus Durandii, Buckley.

Seen on the forks of the Nueces and, what seems a form of it, in the Chisos Mountains. Small tree of little importance, good for fuel, fencing, &c.

Quercus Muhlenbergii, Engelm. (Chestnut Oak.)

Large, handsome tree on the forks of the Nueces, medium-sized in the cañons of the Guadalupe Mountains. Wood strong and durable.

Quercus stellata, Wang. (Post Oak.)

Sparse about San Antonio and northwest of it; nowhere common. I found large groves of it in the hills north of Fort Concho, apparently the westernmost extension of the species. Low, spreading tree, with short stem 1 to 3 feet in diameter; wood hard and durable, excellent for posts, rails, ties, &c., or as fuel.

Quercus undulata, Torr. (Wavy Oak).

Very common, scrubby Oak in foot-hills west of Devil's River, affecting a great variety of forms. Several of the smaller forms (Shin Oak) produce edible acorns of various sizes, small in the Guadalupe Mountains, very large in the Sand Hills, which are eaten by Mexicans, raw or baked. They afford excellent mast to hogs in the vicinity of settlements.

Q. grisea and *Q. undulata* deserve notice as producers of tannin. They almost always bear nut-galls in large quantity. These vary in size from half an inch to an inch in diameter; they sometimes grow upon the smaller twigs, but much oftener spring from the under surface of leaves, generally from the midrib, more rarely from a main lateral nerve, never from the parenchyma. They are found in all stages of development, at first oblong, pointed and reddish, later becoming rounded and yellowish-white. A section of those growing on the leaves shows large open spaces between the central cyst and the external wall; those found on twigs are fuller and heavier. Wherever found, these nut-galls always plainly show the presence of tannic acid.

JUGLANDACEÆ.

Carya olivæformis, Nutt. (Pecan, the Nuez of the border Mexicans.)

Fringes the San Antonio, Medina and Nueces Rivers, many of their branches, and, more sparsely, other water-courses as far as Devil's River and Fort Concho, its western limit. Large and handsome tree, valuable alike for its hard, compact wood and its excellent fruit which forms an important article of trade.

No hickory was seen south of Austin.

Juglans nigra, L. (Black Walnut.)

Sparingly found at San Antonio as a medium-sized tree; does not extend westward. This tree could advantageously be introduced in many valleys.

Juglans rupestris, Engelm. (Cañon Nogal.)

Small tree, hardly ever a foot in diameter, very common in all the mountain arroyos of Western Texas.

Wood of a rich purple-brown, very hard, heavy and compact, not warping in drying. Medullary rays very close, giving a peculiarly fine appearance of silver-grain to a longitudinal section.

URTICACEÆ.

Ulmus Americana, L. (American Elm.)

On the Colorado River at Austin, and upward to a point 75 miles below the crossing of the Texas Pacific Railroad; from this river it ascends the Rio Concho up to Fort Concho. On the Texas Pacific Railroad it only extends to Elm Creek, a few miles west of Abilene.

Large tree on the Middle Colorado, but becoming smaller and of little economic value west of Austin.

Ulmus crassifolia, Nutt. (Water Elm; Small-leaved Elm.)

Much more common than the preceding; abounds on the San Antonio, Medina, Nueces, and other rivers as far as the Pecos. Middle-sized tree, 1 to 2 feet in diameter. Wood tough but not hard, making inferior lumber and poor fuel.

Celtis occidentalis, L. (Hackberry; Palo Blanco.)

The most common tree of valleys and low grounds in Southern and Western Texas. At San Antonio and westward, the straight, short trunk ranges from 6 to 24 inches in diameter; on the Lower Rio Grande it reaches greater proportions, being often 20 feet long and 2 to 3 feet in diameter, the total height of the tree being 50 or more feet. Wood close-grained and tough, but not very durable; makes poor fuel. The fruit is a yellowish-red berry, as large as a pea, with sweet, edible pulp.

This species passes through intermediate forms into the variety *reticulata*, which is very common throughout Western Texas.

Celtis pallida, Torr. (Granjeño.)

Very common on all mesas and foot-hills in Western and Southern Texas. Generally a shrub, but becomes arborescent on the Lower Rio Grande. Plant of quick growth in dry places, stiff and thorny, capable of making excellent hedges. The branches have a disposition to twist into curious shapes and make very pretty canes. Wood hard, making good posts and excellent fuel.

The orange-yellow berry, called capul * by the Mexicans, ripening in the fall, is oval in shape and about half an inch long; it has a mucilaginous and slightly astringent, but not unpleasant, taste, and is greedily eaten by all domestic fowls.

Morus rubra, L. (Red Mulberry.)

Common at San Antonio, where it may have been introduced; probably does not extend farther west. Small, ornamental tree of quick growth, prized for its beautiful foliage and delicious fruit.

Morus microphylla, Buckley. (Wild Mulberry.)

Shrub or small tree, with very variable foliage, common on Las Moras Creek and farther west in the cañons of the Guadalupe, Limpio, and Chenate Mountains. Wood soft and sappy, but tough and resilient, making very good bows. Its cambium is thick and milky, leaving a white deposit wherever it adheres and dries. Fruit round or oblong, rarely seen, much smaller than in the preceding species, maturing in May and very palatable.

Maclura aurantiaca, Nutt. (Osage Orange.)

Spontaneous in Eastern Texas; grows vigorously at San Antonio and wherever planted in Western Texas if near water. Its value as a hedge shrub for valleys and near water-courses is well known.

SAPINDACEÆ.

Ungnadia speciosa, Endl. (Mexican Buckeye.)

Shrub or very small tree, common along rocky valleys and in mountain arroyos west of San Antonio.

The 3-lobed pods contain 3 or more seeds, in shape and size much like small chestnuts. These, although pleasant to the taste, are quite poisonous; cooking does not render them innocuous. An adult can eat one or two with impunity; three or four soon produce giddiness and a sensation of heat and discomfort at the pit of the stomach. In a robust child four years old who came under my observation, after eating two or three of these "beans," the toxic symptoms were quickly produced. Within half an hour he grew very giddy, staggered up to his mother, asked for water and then fell. An emetic of mustard was promptly and successfully administered. A few minutes afterward I found the

* Capul is the Mexican equivalent for berry; it is applied to the fruit of several shrubs, and sometimes, by extension, to the shrubs themselves.

patient with face very pale but resting quietly, free from nausea or pain; there was no inclination to sleep, the pupils were about normal and the respiration natural; the pulse was very high and seemed to be the only serious symptom. Entire recovery followed in a few hours.

Æsculus flava, Ait., and var. **purpurascens**, Gray. (Sweet Buckeye.)

Arborescent shrubs, seen on the Comal near New Braunfels, not extending south or west of that point.

Acer grandidentatum, Nutt. (Small-leaved Maple.)

Small or medium-sized tree, seen in the cañons of the Guadalupe, Organ and Chisos Mountains, the only maple of Western Texas. Wood hard, close-grained, and probably susceptible of a fine polish.

Negundo aceroides, Mœnch. (Box-Elder; Ash-leaved Maple.)

Medium-sized tree on the San Antonio, Medina and other streams east of the Pecos. The abundant sap of this tree contains a large proportion of sugar, together with mucilaginous and demulcent principles, which make it a very pleasant beverage. It is obtained in the early spring by driving a tube, or else cutting out a pocket, into the lower part of the trunk.

Sapindus marginatus, Willd. (Soap-berry.)

Tree often 30 feet or more high, with straight stem seldom a foot thick, common along creeks throughout Western Texas. As a green and thrifty shrub, in a dry and parched district, it is often an indicator of water on or near the surface.

Wood sulphur-yellow, hard, close-grained, resinous and brittle, susceptible of a very fine polish; makes excellent fuel.

The whitish berries, the size of small marbles, have a translucid pulp neutral to litmus paper, rich in mucilage and a detergent principle. A few of them rubbed between the hands will clean them, with hardly any lather, as well as soap. From their neutral reaction they might be found useful in the washing of delicate fabrics.

RHAMNACEÆ.

Rhamnus Carolinianus, Walt. (Alder-Buckthorn.)

Shrub or very small tree on the banks of streams; San Antonio westward to the Pecos; nowhere common.

Rhamnus Purshiana, DC.

Stout shrub in the Guadalupe and (what seems nearest to it) in the Chisos Mountains.

Zizyphus obtusifolius, Gray. (Lote-bush; Texas Buckthorn.)

Next to Mezquit, the most widespread and abundant shrub in Western and Southern Texas, on gravelly mesas, slopes and bluffs. Of quick growth and very hardy, with diffuse and strongly-armed branches, it makes excellent hedges in dry pastures. The large, round, black berries are eaten by Mexicans although nearly tasteless.

I failed to discover the *Z. lycioides* which I judge to be very rare, if at all present, in Texas.

Condalia obovata, Hook. (Brasil; Logwood.)

Shrub at San Antonio and westward, often with the preceding and nearly as common. Becomes a small tree, 20 feet high, on the Lower Rio Grande and along the coast. Wood very hard, of a brick-red color, containing a red (some say purplish) dye. Evergreen of hardy growth in dry, rocky soil, with stiff and thorny branches, making pretty and effective hedges. The small, deep-red berry (capul negro) is acidulous, nice to eat and makes fine jelly.

Condalia spathulata, Gray, and **C. Mexicana**, Watson.

Evergreen shrubs, smaller than the preceding, the former common in Western Texas, the latter on the Lower Rio Grande. Both horridly spinose and excellent hedge-plants. Berries the same as in the preceding.

Ceanothus Fendleri, Gray.

Very thorny and spreading bush in foot-hills beyond the Pecos; also a possible hedge-plant.

Karwinskia Humboldtiana, Zucc.

The Coyotillo of the Mexicans on the Lower Rio Grande; common on the Pecos near its mouth and thence eastward to the coast. Shrub with beautifully penninerved, ovate leaves, and brownish-black berries said to be very poisonous. The virulent principle lies in the seed, the pulp being innocuous. The symptoms are those of paralysis of the spinal cord, primarily affecting locomotion.

OLEACEÆ.

Fraxinus viridis, var. **Berlandieriana**, Torr. (Texas Green Ash.)

The most common Ash of Southern and Western Texas. Large tree in the Chenate Mountains, smaller in the Limpio and Guadalupe Mountains; found also as a medium-sized tree on the Pecos, Devil's River, and most streams farther eastward to San Antonio; occurs sparingly on the Lower Rio Grande, the Gulf Coast, and the water-courses of Southeastern Texas.

Wood hard, tough and close-grained, but rather devoid of elasticity.

Fraxinus pistaciæfolia, Torr.

Low, spreading tree, with trunk 1 foot or more in diameter; frequently planted about El Paso and down the Rio Grande to San Elizario, on account of its quick growth. Also seen as a small tree at the base of the Guadalupe Mountains.

Wood softer than that of the preceding.

Fraxinus pubescens, Lam.

Seen as a small tree on the summit of the Guadalupe Mountains, and nowhere else.

Fraxinus cuspidata, Torr.

Small tree in the Chisos Mountains and some of the cañons of the Great Bend.

Fraxinus Greggii, Gray.

Stout shrub, noticed near the mouth of the Pecos and at Maxon's Spring; only good for fuel.

Forestiera reticulata, Torr.

Small tree, only seen in cañons near the mouth of the Pecos.

Forestiera angustifolia, Torr.

Stout shrub, rather common on bluffs and in mountain arroyos, with a black, edible, but not very palatable, berry.

BORRAGINACEÆ.

Cordia Boissieri, A. DC. (Anacahuita.)

A small tree on the bluffs of the Lower Rio Grande, with hard, close-grained wood. Its various parts, flower, fruit, leaf and wood, all impregnated with the same pleasant aromatic principle, are popularly used by Mexicans in bronchial affections. An extract of the wood is kept in drug stores and prescribed for colds, asthma, phthisis, &c.; it probably acts as a stimulating expectorant and diaphoretic. The fruit is nearly an inch long, with a pointed stone and pulpy, sweet mesocarp of which Mexicans are fond. Most animals, likewise, eat it. A jelly made with it is given to coughing children. A decoction of the leaves is also used internally and externally in rheumatism.

Ehretia elliptica, DC. (Anaqua.)

Seen sparingly near New Braunfels; very common on the Lower Rio Grande as a tree 20 to 35 feet high and stem 1 to 2 feet in diameter, with dark green foliage. Wood tough, making good lumber and fair fuel. Fruit the size of a large pea, yellow, with a thin, edible pulp.

ANACARDIACEÆ.

Rhus copallina, L. and var. **lanceolata**, Gray. (Dwarf Sumach.)

Shrub, 8 to 12 feet high, found, the variety chiefly, in many places west of San Antonio.

Rhus virens, Lindh. (Live Sumach.)

Shrub found in shady arroyos and on lower slopes of mountains, west of the Nueces River. The leaves, mixed with tobacco, are smoked by Mexicans and Indians.

Rhus aromatica, var. **trilobata**, Gray, and **R. microphylla**, Engelm.

Both abundant on bluffs and slopes.

R. copallina contains tannin in its leaves and bark; this acid may also be present in the other species mentioned. The berries of all Sumachs are astringent, acidulous, and make agreeable infusions.

Rhus Toxicodendron, L. (Poison Ivy.)

Very common woody climber on all the streams of Western and Southern Texas, readily recognized by its trifoliate (rarely quinquefoliate) leaves.

The peculiarly distressing eczematous inflammation produced by the leaves of this plant, even without actual contact, is well known. It is said to be promptly checked and cured by the fluid extract of Serpentaria. The tincture of *Grindelia robusta*, the Gum-plant of California, used as a remedy in poisoning by *Rhus diversiloba*, and that of *G. squarrosa*, a common herb in W. Texas, may also be found useful against Poison Ivy.

Pistacia Mexicana, HBK.

Small tree, with an edible nut, found by Bigelow near the mouth of the Pecos. I failed to see it in that locality or anywhere else in Texas.

VITACEÆ.

Vitis candicans, Engelm. (Mustang Grape.)

Common along streams, at San Antonio, westward to Devil's River and southward to the Rio Grande. The best of the wild Texas Grapes, the small bunches of large berries maturing late in June. A form was seen on the Rio Salado, near San Antonio, with more acidulous berries, ripening later in the summer.

Vitis æstivalis, Mx. (Summer Grape.)

High climber, common at San Antonio and westward to Devil's River. Berries rather acerb, much smaller and maturing later than in the preceding. The var. *cinerea*, common at Dallas, is rare in Southwestern Texas. A form (close to *V. riparia*) was seen in the cañons of the Bofecillos Mountains and farther west, with very palatable fruit ripe in August.

Vitis riparia, Mx. (Arroyo Grape.)

Common in most watered cañons in Western Texas. Thrifty climber, the small but excellent berries maturing in October.

Vitis rupestris, Scheele. (Mountain Grape.)

Small, bushy plant, a few feet high, rarely climbing. Said to grow on the hillsides of the Limpio and other mountains. I only found it in the valley of Devil's River. Berries in very small bunches, ripening in June.

Vitis incisa, Nutt. (Yerba del Buey.)

Ornamental vine, with 3-lobed, or trifoliate, shining, fleshy leaves; common on fences and walls at San Antonio, and south and west of it in shady places. The long, filamentous roots bear large, globose, tuberous thickenings, like marbles or balls strung on a string, which are very poisonous, causing violent vomiting and purging.

The stem and foliage are said to cause, on susceptible persons, the same eczematous eruption as Poison Ivy. The juice of the purple berry "is mixed with cochineal and used by Mexicans to dye red".

ROSACEÆ.

Prunus Americana, Marsh., var. **mollis**, T. & G. (Wild Yellow Plum.)

Small tree, rather sparse on the San Antonio River and tributaries, with yellow fruit, smaller and less palatable than that of the species in the Northern States.

Prunus rivularis, Scheele. (Creek Plum.)

Small shrub, not uncommon on the Colorado and its tributaries, bearing excellent red plums in August and September. Also found in foothills, but with smaller stem and fruit.

Prunus Capollin, Zucc. (Choke Cherry.)

Closely allied to *P. Virginiana* and *demissa*, into which it may run. Found in most mountain cañons of Western Texas, from a stout shrub to a tall, slender tree 1 foot in diameter (Chisos Mountains). The round, black fruit, the size of a large pea or small marble, is pleasantly acidulous.

Cratægus subvillosa, Schrad. (Texas Black Thorn.)

Small tree, on the San Antonio River and tributaries, rare farther west and south.

Rubus trivialis, Mx. (Low-Bush Blackberry.)

Common at San Antonio and along the streams farther west and south.

SOLANACEÆ.

Solanum elæagnifolium, Cav. (Trompillo.)

One of the most common of weeds in all valleys of Southern and Western Texas. To the large, purplish-violet flowers succeed berries, at first green, turning yellow and then black as they mature, the size of small marbles. These berries, when ripe, although they give no acid reaction, have the remarkable property of curdling milk, and are used for that purpose by the natives of Northern Mexico and Southern Texas. They are crushed into powder; this is put into a small muslin bag which is left suspended in the milk until coagulation has taken place.

According to Dr. Gregg, Mexicans also use the fruit as a sudorific and sternutatory.

Probably the larger berries of *S. Torreyi* have analogous properties.

Nicotiana glauca, L. (Coneton; Tronadora.)

Rare along the Rio Grande (only found at two or three places in the wild state); frequently cultivated in gardens as a handsome, ornamental shrub of very quick growth. The young stems are easily killed by

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frost, but new shoots spring forth which during the first summer reach the altitude of 12 to 15 feet.

The large, glaucous, thickish leaves are used as healing and anodine poultices.

Nicotiana repanda, Willd., and **N. trigonophylla**, Dunal. (Wild Tobacco.)

Herbs common, the first at San Antonio and westward to Devil's River, the second west of this stream; the nearest Texan relatives of smoking tobacco. Although not entirely devoid of aroma they do not seem of much account for smoking.

Capsicum baccatum, L. (Bird Pepper; the Chiltapin of Mexicans.)

Very small, slender shrub, sparsely found in Southwestern Texas. Its red, oval berries are exceedingly pungent and highly prized as condiment.

EUPHORBIACEÆ.

Euphorbia albomarginata, T. & G., **E. stictospora**, Engelm., **E. cinerascens**, Engelm., &c.

Small, prostrate herbs, common in Western Texas where, as in Chihuahua and Sonora, they are known as Golondrina and reputed effective antidotes against the poison of rattlesnake. The var. *appendiculata* of the last-named species, according to Mr. Thurber, is regarded by the Mexicans of Sonora as a certain cure for the bite of rattlesnake and other venomous animals: "The bruised fresh plant, or the dried, steeped in wine, is applied to the wound. A tincture of the plant is sometimes kept in the apothecary's shops of that country."

Euphorbia antisyphilitica, Zucc.

On the gravelly and limestone hills of the Rio Grande; "remarkable for its long, terete, nearly leafless branches, which resemble an *Equisetum*." Whether this herb is endowed with such properties as its name indicates, I have been unable to ascertain.

Mozinna spathulata, Orteg. (Sangre de Drago, or simply Drago.)

Erect, shrubby plant, with simple, flexible, brownish stems, bearing wart-like spurs from which grow linear spatulate, or 3-lobed, leaves. Common on the gravelly bluffs of the Rio Grande.

The stems, from their flexibility and toughness, can be used as withes and whips. They, as well as the roots, contain a reddish, astringent juice which becoms quite frothy when rubbed, and are employed by the natives as a remedy to cleanse the teeth and harden the gums. The juice can also be used to make indelible marks on linen.

Jatropha macrorhiza, Benth. *J. multifida.*

Species of Spurge-Nettle, with slender, reclining stems and pretty foliage, growing from a large, globular rhizoma. Common on the Lower

Rio Grande where it is called Jalapa by Mexicans. The rhizoma is emetic and purgative; it is kept, powdered, in the drug stores of Northern Mexico. The seeds are also strongly purgative.

Croton corymbulosus, Engelm. (Encenilla; Chaparral Tea.)

Very common weed of valleys and prairies. An infusion of the flowering tops, either green or dried, makes an excellent tea having sudorific, carminative and tonic properties, but devoid of stimulating and astringent principles. It is much used by Mexicans, Indians and colored United States soldiers. The latter prefer it to coffee in the field.

The *C. suaveolens*, a small shrub in the foot-hills of mountains, exhaling a delicious fragrance, would probably likewise make an excellent tea.

Acalypha Lindheimeri, Müll.

Perennial herb, with many weak, ascending, downy stems, on hillsides in Western Texas. "According to Dr. Gregg, this plant is used by Mexicans as a wash for sore gums and loose teeth, and as an application to ulcers."

ZYGOPHYLLACEÆ.

Larrea Mexicana, Moric. (Creosote-Bush.)

Very common shrub on gravelly mesas and bluffs west of the Pecos. It owes its name to the unpleasant tarry odor which it exhales. The branchlets are often covered with an abundant red-brown exhudate from which, according to Dr. Loew, can be obtained a red coloring matter showing all the reactions of cochineal. The leaves contain a peculiar resinous substance, soluble in alcohol, to which is due the peculiar smell of the plant and its active properties. It is principally used in rheumatic affections by the Mexicans, who bathe in an infusion of the branchlets and leaves. This infusion is acrid and nauseous and does not seem to be ever taken internally. It is used by Mexican shoemakers to dye leather red.

The green branches and foliage burn with a bright blaze giving off intense heat, and are much used in lime-kilns.

Porliera angustifolia, Gray. (Guayacan.)

Evergreen, straggling shrub on bluffs, or a very small tree in valleys and sheltered cañons, from the Lower Rio Grande to San Antonio and the Pecos; more sparingly beyond.

This shrub has probably, in a varying degree, all the properties of the genus *Guayacum* to which it is closely allied botanically. Wood heavy, close-grained, very compact olive-green in the center and with a large yellowish zone of sap-wood. Although somewhat brittle, it must be of much value to cabinet-makers. A decoction of it is used by Mexicans as a vascular stimulant and sudorific, in rheumatism, amenorrhœa and venereal diseases.

Posts of Guayacan are said never to decay, and therefore must be of much value for fencing. The bark of the roots, ground, possesses strong detergent properties and is reputed excellent to wash woolen fabrics.

RUTACEÆ.

Xanthoxylum Clava-Herculis, L. *X. Carolinianum*, Lam. (Prickly Ash; Toothache-Tree.)

Prickly shrub, with pinnate leaves; common on banks of streams.

Xanthoxylum Pterota, HBK. (Colima.)

Very common shrub on the Lower Rio Grande; distinguished from the preceding by the winged-margined petioles and smaller leaflets. Wood yellow, dense, exceedingly hard and heavy.

The bark, leaves and fruit of these two species are very pungent and acrid, causing a strong and lasting tingling sensation in the tongue and lips, followed by partial numbness. The former is officinally used in decoction as an arterial and nervous stimulant. The leaves of both, chewed, are an effective sialogogue.

Helietta parvifolia, Benth. (Barreta.)

Shrub common on the bluffs of the Lower Rio Grande, apparently only good for fuel.

Ptelea trifoliata, L. (Hop-Tree.)

Shrub or very small tree on the San Antonio River and other streams of Western Texas.

Ptelea angustifolia, Benth.

Shrub said to occur on the Lower Rio Grande; probably rare.

SIMARUBEÆ.

Castela erecta, Turpin. (Goat Bush; the Amargoso of the Mexicans.)

Stiff, branching, prickly shrub, 3 to 5 feet high, common on the gravelly bluffs of the Lower Rio Grande from Eagle Pass downward. An excellent hedge-plant for high and rocky places.

The bark is intensely bitter and probably contains tannin and some principle akin to quinine. Its decoction is used by Mexicans as an astringent, tonic, and febrifuge. The remarkable properties of this bark, and perhaps of the wood, seem to warrant fuller investigation.

Kœberlinia spinosa, Zucc. (Junco.)

Very curious shrub, destitute of apparent foliage, the green, stiff, very intricate branches all tapering into thorns. Common in Western and Southern Texas from El Paso to Brownsville. On the Lower Rio Grande it becomes arborescent. Makes quite formidable hedges.

Wood of a very deep brown color, resinous, hard and heavy; it burns with a bright blaze, giving off intense heat and a disagreeable smell.

LILIACEÆ.

Yucca baccata, including var. **australis**, Eng. (Spanish Bayonet or Dagger; the Palma Criolla of the Mexicans.)

Variable in size, from a mere cluster of leaves on a very short caudex to a tree 30 feet high and 18 inches or more in diameter. Common on high mesas throughout Western and Southern Texas; specially large and thrifty on the wide slopes leading up to the base of mountains.

The leaves of this Yucca yield an excellent textile fiber; for this and other reasons it is considered one of the most valuable economic plants of Texas.

Every year a tuft of leaves, from ten to twenty, grows on or near the summit of the plant; they attain their full development the second season, with the inflorescence of the gorgeous panicle of flowers, and for several years remain green and pliable. As the tree becomes fifteen or more years old, the lower leaves begin to shrink; later they droop and wither into membranaceous shreds, forming a thick thatch around the stem of the tree. This thatch is very useful for kindling fires in the field, the inner layer always remaining dry in rainy weather.

On old trees, the only available leaves, that is, those of the last four or five years, are about the summit and therefore of difficult access; they are also likely to be short and dwarfed. The best leaves are those produced by trees not more than about fifteen years old; before that age has been reached several hundreds of leaves can be collected. In order not to injure the growth of the stem, the last one or two clusters, near the top, should be spared. It would be well to cut off the young flower stalk as soon as it is fairly developed in order to divert the sap into the leaves.

The length of the full-grown leaf is 3 to 4 feet, yielding a fiber averaging 3 feet and 3 inches. This fiber is not as strong as that of the Lechuguilla, but is said to compare favorably with that of hemp; it is whiter, smoother and more flexible than the former, and makes prettier fabrics. It is obtained by the same process.

The leaf, when slightly parched, becomes very supple and can be split into several strands which are used as whips and withes, and made to answer all the purposes of rope and string; with them are tied up the sheaves at harvest time, the bundles of hay cut on the mesas, the various articles carried on the saddle and the burro's pack, &c.

The roots, pounded and reduced to a pulp by adding water, are used by Mexicans and Indians as an excellent substitute for soap, under the general name of "amole," and are not probably much inferior in this respect to Lechuguilla leaves. According to Dr. Loew, they contain sugar, resin, tannin, gum, and saponin. The latter substance is what makes this "amole" foam like soap when shaken or rubbed with water and gives it detergent properties. The parenchyma, or pith, remaining

after the extraction of the fibers, and constituting about one-third in weight of the leaves, may possibly also contain saponin.

Every year this plant puts forth a huge and dense cluster of white flowers, succeeded by fleshy pods which as they mature, assume somewhat the size and shape of bananas. The pulp, half an inch thick, which covers the seeds, is delicious if exactly ripe. Unfortunately it often happens that this pulp decays before, or is eaten up by insects after, maturity. If picked when still a little green and laid in a dry place, the pods will ripen sufficiently in a few days to be very palatable.

They are also distilled; from them much aguardiente, or rum, is made in Northern Mexico.

Yucca angustifolia, Pursh, and **Y. rupicola**, Scheele.

These two species, common, the former west and the latter east of the Pecos, are also "amole" plants, containing in their roots more or less of the detergent saponaceous substance described above. As textile plants they are of but little importance.

Dasylirion Texanum, Scheele. (Bear Grass; the Sotol of the Mexicans.)

Characterized by a thick tuft or cluster of long, green, armed leaves, from the midst of which rises periodically a stout stem 10 to 12 feet high, bearing a long, close panicle. Abundant west of the Pecos, covering almost exclusively many square miles of arid and stony slopes, the most striking botanical feature of the country. Also found on nearly all the foot-hills of Western Texas.

The stems can be used in building huts where timber is scant, and make fair fuel in places where no other can be had.

The base of the leaves, and the young stems, are full of a nutritious saccharine and antiscorbutic pulp which supplies, specially when cooked, useful and palatable food. Bears are fond of it, as testify the many plants found pulled up and torn open in the spring. After the leaves have been chopped off close, leaving nothing but their white expanded and imbricated bases, the resulting "head" is ready for cooking; it can be boiled, broiled on coals, or baked. Baking, the usual mode of preparing it for food or the distillation of mescal, is done in a small heated pit where it is kept for about twenty-four hours.

The baked head, after pounding, fermentation and distillation, produces a limpid, colorless liquor of penetrating smell and peculiar taste not unlike the smoky flavor of Scotch whisky. It is the Sotol mescal, the ordinary alcoholic beverage of the frontier Mexican population, and in no way inferior to the average whisky found in that country.

The mescal, vino mescal or taquile, of the interior of Mexico, is obtained in a similar manner by the baking and distillation of the head, or cajeta, of the Mexican Maguey (*Agave Americana*). It is a liquor of superior quality to Sotol mescal. It should not be confounded with "pulque," the sweetish, mild beverage so popular in the cities of Mexico,

obtained from the sap of the *Agave Americana*, gathered in the cavity made in the heart of the plant by the removal of the young central leaves.

As a textile plant Sotol is worthless.

Nolina Texana, Watson.

Abundant on all the foot-hills of Western Texas. Used by Mexicans to thatch their huts, or jacals, and make brooms.

AMARYLLIDACEÆ.

Agave heteracantha, Zucc. (Lechuguilla.)

This notorious plant begins west of Devil's River and infests most of the limestone highlands of Southwestern Texas, often covering the ground in such dense patches as to make it impassable for man or beast. It is pre-eminently the textile plant of Northern Mexico.

It blossoms when three or four years old and then dies. Its reproduction from root-stock and seed is easy and rapid. Each plant consists of a cluster of about a dozen leaves armed on the edges with hooked prickles and tipped with a stiff, black spine. They vary in length from 1 to 2 feet and in width from 1 to 2 inches, and yield a fiber of an average length of 15 inches, which is considered the toughest and most durable of any produced in Mexico. With it are made all the ropes (not hair) and most of the bags, mats, &c., used in the Republic. The defects of the Lechuguilla fiber are its coarseness and shortness. It is obtained as follows: The leaves, trimmed and separated, are crushed between rollers which squeeze out a large amount of glutinous, soapy, connective pith; they are then exposed to the sun for half a day or more, when the fibers are easily separated by hand or still better by machinery which, at the same time, removes the remaining pith. The Mexicans, mostly unprovided with machinery, still scrape the green leaves with knives; the shreds and shavings thus obtained are left to dry a few hours upon the ground, then they are thoroughly washed to rid them of all the mucilaginous pith, and finally the fibers are picked or combed apart.

Lechuguilla is the most important of the soap or "amole" plants of Southwestern Texas and Northern Mexico. In the process described above to extract the fiber, the parenchyma or pith squeezed out, constitutes about 40 per cent. of the green leaf; when dried it is a white-yellowish, mucilaginous powder which possesses remarkable cleansing properties, principally due to the presence of saponin. Its composition is very probably analogous to that of the root of *Yucca baccata*, already noticed. Rubbed with water, it foams and lathers, answering the purpose of good soap without, owing to its freedom from alkali, its disadvantages. It imparts a smooth and satiny appearance to the skin, and is used successfully in removing stains from the most delicate fabrics. It tends rather to set than to displace colors, and articles likely

to fade may be washed with this in safety. It is also an excellent wash for the scalp and hair, leaving the latter soft and glossy. If this powder could be compressed into small cakes or tablets, it would doubtless become an important article of trade.

Mexicans and Indians, after removing the prickles, pound the leaves into a pulp which they use instead of soap.

Agave Wislizeni, Engelm. (Texas Mescal.)

The noted Mescal plants of the Arizona Apaches (*Agave Palmeri* and *Parryi*) do not extend to Texas. They are replaced in all the mountains of Western Texas, from the Guadalupe to the Chisos, by a larger and taller species, *A. Wislizeni*, formerly used by Texas Indians in the same way. The heart of the plant, before it puts forth the flowering stalk, with the leaves trimmed off close, forms the "head" which is baked in heated pits. Some of the old pits can still be seen in the Guadalupe Mountains. Cooking develops a large proportion of grape-sugar which renders this head pleasant and nutritious food. The sugar, according to Dr. Loew, exists in combination with citric acid, as a citro-glucosid, and is set free by exposure to heat or on application of cold water.

The leaf contains textile fibers, but they are too short and too few to be of much account. When young it yields by pressure a juice slightly acidulous, laxative and diuretic, therefore a good antiscorbutic.

The young stems, when they shoot out in the spring, are tender and sweet-tasted; they are then eaten with great relish by Mexicans and Indians.

It is probable enough that the leaves and roots contain more or less of the same detergent saponaceous substance as Lechuguilla.

Agave Americana, L. (Mexican Maguey.)

This plant, of such vital importance to Mexico, is also spontaneous at a few points in Southeastern Texas where it might be advantageously cultivated, not only for its fiber but also for the pulque and mescal which it yields.

Agave Sisalana, Perrine.

The Ixtli or Pita plant of Mexico, the most valuable of the fiber-producing Agaves, naturalized in South Florida. It has been successfully introduced on the Lower Rio Grande.

CACTACEÆ.

Cereus stramineus, Eng. (Strawberry Cactus; Pitahaya.)

Very common west of the Pecos where it grows in large hemispherical masses; rarer in Southeastern Texas. The ripe fruit is red, $1\frac{1}{2}$ inches long, 1 inch thick, with thin skin bearing but few spines and easily peeled off. It is equal or superior, in quality and flavor, to the best strawberry. The seeds, scattered through the pulp, are so fine as to be unnoticed. Only a comparatively small number of blossoms ripen

their fruit, so that, although the plant is abundant, the berry exactly ripe and untouched by insects is never common. Whenever the traveler notices the pink fruit, glowing through the long spiny straws besetting the stem, he seldom fails to dismount and secure it, even at the risk of getting his hands badly punctured.

Cereus dubius, Eng., and **C. enneacanthus**, Eng.

Species allied to the preceding and common from El Paso down to the Lower Rio Grande; edible fruit, varying in size and quality, seldom ripening.

Cereus dasyacanthus, Eng.

About El Paso and downward to the Cañon of the Rio Grande, on rocky hills. "Fruit subglobose, 1 inch in diameter, green or greenish purple, when fully ripe delicious to eat, much like a gooseberry."

Echinocactus longehamatus, Galeotti. (Turk's Head.)

Common along the Rio Grande, specially in the Great Bend country. Heads 1 to 2 feet in diameter, with long, hooked spines. Fruit ripening in September, 1 to 2 inches long, red, and as delicious as that of the Strawberry Cactus.

E. horizonthalonius, Lemaire, and perhaps others, under the name of Bisagre, are sliced, candied in Mexican sugar and kept in confectioneries.

Mamillaria meiacantha, Eng.

Common at San Antonio and southwestward into the Great Bend. The oblong scarlet berries, an inch or less long, are very good to eat.

Mamillaria tuberculosa, Eng.

Common west of Devil's River. The red berries are also very palatable.

Opuntia Engelmanni, Salm. (Prickly Pear.)

This and other species of flat-jointed *Opuntia*, known under the name of Nopal,* abound all over Southern and Western Texas.

The joints, erroneously called "leaves," are readily eaten by cattle and sheep for which they are an important article of food. It is well, as far as practicable, to make them undergo a preliminary scorching for a few moments, over a bright fire, to burn off the bristles and blunt the spines. I have seen cattle eating Nopal leaves with great relish in the open field, although there was good green Grama near by, seemingly indifferent to the many bristles and spines sticking to their noses. There are times when they prefer them to any other food. These leaves contain a large proportion of water and often save cattle and sheep from great suffering in dry seasons. If the time of drought be much pro-

* The Mexican names Nopal and Tuna should not be confounded; the former refers to the leaves, the latter to the fruit of the several species of Prickly Pear.

longed, however, they lose much of their water by evaporation and become very thin; the pulp shrinks and the fibrous frame-work preponderates; in this state they are liable to cause sickness in animals feeding on them. During the three or four winter months, on the Lower Rio Grande, sheep often get no other food than Nopal leaves. Every morning the shepherd cuts down, with his hand-ax, or "machete," the amount required for the day; as a rule he does not fire them. It is to be noted that as long as they feed on them the sheep require no drinking water.

The Nopal leaf is much used by Mexicans and frontiersmen as a poultice in bruises, ulcers and sores of all kinds. It is first slightly toasted to remove bristles and thorns, as well as to warm and soften the pulp; then it is split in two, or simply one of the surfaces shaved off, and the exposed pulp applied to the part. From the testimony of many intelligent people I am inclined to regard this as an excellent healing and gently stimulating application.

It is also useful to clarify water. After being scorched it is mashed into a pulp which when thrown in water, like egg albumen, drags all impurities to the bottom.

Again, this leaf may be prepared for food by boiling it in salt water; if afterwards cut up into a hash with eggs and chile colorado, it makes quite a savory dish.

Opuntia Engelmanni, *dulcis*, and other species of flat-jointed Prickly Pear, common along the Rio Grande and Southwestern Texas, produce large berries, 1 to 2 inches long, full of a purplish pulp, sometimes sweet and pleasantly acidulous, at other times insipid and nauseous, and always full of small, indigestible seeds. Mexicans and Indians are fond of them.

The *O. Engelmanni*, on the Lower Rio Grande, and *O. tuna* in Northern Mexico and California, which under favorable conditions grow stout and tall, with a tendency to spread, are often trained into hedges around houses and gardens, which are as effective as ornamental. These plants are easily grown, as any joint stuck in the ground generally takes root.

Anhalonium fissuratum, Eng. (Peyote.)

Napiform cactus, with flat, fissured top, hardly rising above the ground, producing a handsome pink flower in the early summer. Found on rocky highlands west of Devil's River, specially in Presidio County, extending thence into Mexico.

The fleshy part of the plant is used, and pieces are found in most Mexican houses. An infusion of it is said to be good in fevers. It is principally as an intoxicant that the Peyote has become noted, being often added to "tizwin" or other mild fermented native drink to render it more inebriating. If chewed it produces a sort of delirious exhilaration which has won for it the designation of "dry whisky."

CUCURBITACEÆ.

Cucurbita perennis, Gray. (Calabacilla.)

This creeping vine, with its large, rough, whitish, triangular leaves, is very abundant in all valleys of Western Texas, and extends to California. The fruit, when ripe, is about the color and size of an orange.

Brewer and Watson state, in Fl. Cal., "that the pulp of the green fruit is used with soap to remove stains from clothing, and that the macerated root is used as a remedy for piles and the seeds are eaten by the Indians."

The leaves bruised between the fingers emit a nauseous smell. When eaten by cows in the spring, as sometimes happens, a very disagreeable flavor is given to their milk and butter.

This plant has an enormous fleshy root which enjoys medicinal properties among Texans, but I was not able to ascertain what they are.

Apodanthera undulata, Gray. (Melon Loco.)

Common in places. As the name indicates, the fruit is considered poisonous by the Mexicans. On the contrary, the large napiform root is said to be esculent.

Maximowiczia (Sicydium) Lindheimeri, Watson.

Common in the valleys of Southern and Western Texas. Thrifty ornamental vine, climbing over trees and bushes, with beautiful scarlet, pendent berries, the size of large pigeon's eggs.

Citrullus vulgaris. (Watermelon.)

Found in the wild state, west of the Pecos, in many places where the seeds were carried by water or other agencies.

KRAMERIACEÆ.

Three species and one variety of *Krameria* are common in Western and Southern Texas. They all contain tannin, and, like *K. triandra* of South America, to which they are closely allied, may be found useful medicinal plants.

They are: *K. lanceolata*, a decumbent herb, only ligneous at the base; *K. parvifolia* and its var. *ramosissima*, low, straggling, much branched bushes; *K. canescens*, small bush, one to three feet high, particularly abundant in the Great Bend of the Rio Grande. The latter is called Chacate by the Mexicans who use an infusion of the bark of the root to dye leather brownish-red.

COMPOSITÆ.

Helianthus annuus, L., including **H. lenticularis** of Douglas. (Common Sunflower.)

Abundant in all valleys. Seeds used for food by Indians and to fatten poultry by Mexicans, yielding by expression a fair quality of oil.

Grindelia squarrosa, Dunal. (Gum Plant.)

Common on prairies west of the Pecos, and, like its congener, *G. robusta* of California, probably useful in bronchial affections and as a topical application in poisoning by *Rhus toxicodendron*.

Parthenium hysterophorus, L.

One of the commonest weeds about the streets of San Antonio. Contains a bitter principle associated with an essential oil. An infusion from the tops is said to be useful in some forms of dyspepsia and in intermittent fever.

Hymenatherum Gnaphaliopsis, Gray.

Small, spreading, woolly herb of Southern Texas, called Lepiana by the Mexicans, and used by them and the Indians as a remedy for catarrh.

Engelmannia pinnatifida, T. & G.

Perennial herb, common on the high prairies of Western Texas, said to be poisonous.

Bidens Bigelovii, Gray.

Species of Spanish Needles, common in the foot-hills of Presidio County, and valued by Mexicans as one of their best tea plants. The leaves are collected during the time of inflorescence, parboiled and then dried in the sun, when they are ready for use. Their infusion has sudorific, carminative and tonic properties.

Chrysactinia Mexicana, Gray.

One of the Damianas of the Mexicans. Small, branching bush, a foot high or more, with heath-like leaves, punctate with round oil glands, exhaling a strong resinous, aromatic odor. Found rather sparingly in rocky foot-hills of Western Texas. Used by Mexicans, mostly as a sudorific, in rheumatism and fevers.

Pectis angustifolia, Torr., **P. longipes**, Gray, and **P. papposa**, Gray.

Small, lemon-scented herbs, with abundant star-like yellow blossoms, filling the air with their fragrance. Common in Western and Southern Texas. It is probable they would yield by distillation a rich perfume.

Actinella odorata, Gray. (Limonillo.)

Herb with filiform-dissected leaves, in Southern Texas. Also a perfume plant.

MISCELLANEOUS.

TREES AND SHRUBS.

Diospyros Texana, Scheele. (Mexican Persimmon; the Chapote of the Mexicans.)

Often found on rocky mesas but thrives best in cañons and on the edges of ravines. Common from San Antonio westward and southward. Shrub or small tree 10 to 20 feet high, with soft, white wood.

The black, globose fruit, smaller than its congener of the Eastern States, is about as astringent when green and as sweet when ripe, in August and September. I have not seen any unpleasant effect from its free use in the field. Stains black everything it touches, and Mexicans use it to dye sheep skins by boiling.

Chilopsis saligna, Don. (Desert Willow.)

Small ornamental tree of the Bignonia Order, with willow-like foliage and handsome pink or purplish flowers. Common in all dry mountain arroyos west of the Pecos. Often cultivated in gardens. Mexicans use the flowers in fevers and as a stimulant in cardiac diseases.

Berberis trifoliolata, Moric. (Three-foil Barberry.)

Pretty shrub, 2 to 5 feet high, with stiff, trifoliate, spinescent leaves, on gravelly slopes and foot-hills; common from the Gulf Coast to San Antonio, and westward to the Limpio Mountains.

Produces red berries as large as peas, in handsome clusters, ripening in May; they are acidulous, pleasantly flavored, and make excellent jelly.

Berberis Fremonti, Torr.

Rare shrub in mountain cañons, with yellow, very hard wood, and dark-blue berries the size of currants.

Fouquiera splendens, Eng. (Ocotillo; Jacob's Wand.)

Very striking and ornamental plant, with long, prickly shoots, tipped in summer with a cluster of scarlet flowers. Common on rocky mesas from the Pecos to the Colorado.

The cut stems, stuck into the ground, grow with remarkable facility, and are much used by Mexicans who plant them close to one another, forming tall, impenetrable barriers around yards. They are impregnated with a resinous substance which makes them excellent fuel; the small scales, or chips, which can generally be detached from the base, are of great service in starting a camp-fire. The leaves, chewed, are pleasantly acidulous.

Sabal Palmetto, R. & S.? (Palmetto.)

In sparse clumps from the mouth of the Rio Grande up the river to Edinburgh. Tree 20 to 30 feet high, apparently identical with the Palmetto of South Carolina.

Arbutus Xalapenses, HBK.? (Madroña.)

Shrub and small tree in the foot-hills of the Guadalupe, Limpio and Chisos Mountans, with soft wood only fit for fuel. Yellowish-red berries, the size of currants, rather pleasant-tasted.

Bumelia lycioides, Gærtn.

Called Coma by the Mexicans on the Lower Rio Grande where it becomes a tree with stem a foot thick. Wood tough and compact, making excellent ax-handles. The black berries are edible but not very palatable.

Ribes viscosissimum, Pursh.

The only Gooseberry seen in Western Texas, growing sparingly in the Guadalupe Mountains.

Ribes aureum, Pursh. (Buffalo Currant.)

The only Currant seen; in shady ravines; rare.

Cocculus Carolinus, DC.

Very common climber along streams, with edible red berries the size of small peas.

Lippia lycioides, Steud.

Very common shrub on rocky slopes, with long sprays of white flowers exquisitely fragrant. Foliage eaten by cattle, sheep and goats.

Lantana Camara, L.

Low bush, with dark green foliage and handsome golden-orange flowers, considered poisonous to sheep and cattle in Southeastern Texas; it is noticed they always shun it, even where grass is scant.

HERBS.

Rumex hymenosepalus, Torr. (Cañagre.)

This Dock or Sorrel, a noted tannin plant, is easily distinguished by its very large, ovate-lanceolate leaves, a foot or more long, but more particularly by the large membranaceous, pinkish sepals, half an inch or more broad. Common west of the Pecos, in valleys and generally not far from streams. Thrives best in light, sandy or gravelly soil. I have seen it flourishing, near El Paso, on sand hills 30 feet or more above the level of the Rio Grande.

Annual, chiefly propagated by its tubers. Stem 2 to 3 feet high, withering early in summer. Followed under ground, it becomes white and slender, and at a depth of about a foot gives off a first cluster of tuberous roots which lead to other clusters, so that a single plant often yields ten to fifteen tubers. Each of these is 2 to 4 inches long and 1 to 2 thick, with yellowish-brown pulp very astringent and bitter to the taste.

When dug out during the winter, Cañagre tubers can be kept a year or more without deteriorating or impairment of their germinative power. If planted in the spring, they sprout in three or four weeks. At San Antonio, where Colonel Terrell, U. S. A., had quite a number planted, apparently under favorable conditions, they nearly all sprouted in time and the young plants thrived until they became 6 inches or more high when they suddenly withered and died; whether from drought, careless tilling, or other cause, I was unable to ascertain.

According to the analysis made by the Department of Agriculture (Report for 1878), the air-dry roots, with 11.17 per cent. of moisture, contain 23.45 per cent. of tannic acid, equivalent to 26.30 per cent. of tannin in strictly dry root. This tannic acid is of the variety known as rheo-tannic acid and identical with that existing in rhubarb. Besides this acid, alcohol also extracts some sugar and a red substance

soluble in water (aporetin). This root contains also a considerable proportion of starch.

Mexicans use an infusion of the mashed tubers for tanning. The skins, after being dried, are simply placed in vats full of this infusion. A reddish color is at the same time imparted to the leather.

The foliage is intensely bitter and astringent so that it probably also contains tannin.

Eriogonum.

Several species of *Eriogonum* grow abundantly on the slopes and foot-hills of Western Texas. It is probable that the roots of some of them contain tannin. The long, tapering roots of *E. longifolium* are very astringent to the taste, probably owing to the presence of this acid.

Calophanes linearis, Gray.

An inconspicuous member of the Acanthus Family, common herb on dry prairies, with opposite, narrow leaves one to two inches long, and showy purple axillary flowers leaving after them the persistent calyx with long, hispid sepals. This is the Snake-Plant of Northern Coahuila and the Lower Rio Grande.

The plant, root and all, is bruised or pounded with a little water, or partly chewed in the mouth, and applied to the bite without any further preparation. At the same tine it should also be eaten, or, still better, an infusion of it administered internally, *ad libitum.* It is tasteless and to all appearances devoid of active properties. In the Mexican colonial troops stationed along the river, every man carries, by orders, a small package of this plant in his pocket, and the officers are most emphatic in their assurances of its efficacy. I have heard of a man in one of the interior towns of Coahuila who will cause himself to be bitten by a rattlesnake for a dollar, if allowed to use this antidote.

In a region where venomous animals are so common it does not seem improbable that nature may have provided vegetable antidotes against their poison. Every Mexican State boasts a certain number of *yerbas de la vibora*, for the wonderful powers of which everybody seems willing and anxious to vouch. Their very multiplicity, however, makes one seriously doubt the value of any particular one. Whether such natural antidotes exist has not yet been scientifically demonstrated.

Rivina lævis, L. (Small Poke-Weed.)

Herb with lignescent base, common in all shady places, producing red berries with a thin, edible pulp.

Malvaviscus Drummondii, T. & G. (Wild Fuschia.)

Tall and pretty herb of the Mallow Family, at San Antonio and North-eastward, producing, late in summer, palatable scarlet berries which are eaten raw or cooked.

Talinum aurantiacum, Eng.

Elegant little plant, with fleshy leaves and golden flowers, found everywhere west of the Pecos; has a tuberous root good to eat when cooked.

Martynia fragrans, Lindl. (Toloache.)

This Unicorn-plant, not unfrequent in Western and Southern Texas, is endowed, in the fertile imagination of the Mexicans, with the remarkable property of developing, in those to whom it is administered, gradual and permanent insanity.

Nasturtium officinale, R. Br. (Water Cress.)

Whether introduced or native, has taken possession of most of the streams in Western Texas.

Selaginella lepidophylla, Spring. (Siempre Vive; Rock Rose.)

Very remarkable moss-like plant, common on the limestone bluffs of the Lower Pecos and of the Rio Grande. While apparently withered and dead, it can be collected and kept for months in a dry place, when, if the roots be placed in water, it begins to unfold its curled and prettily dissected fronds, fully expands and becomes green again, remaining so as long as moisture is furnished. It can be allowed to dry and made to revive again many times before losing its vitality.

Eurotia lanata, Moq. (White Sage; Winter Fat.)

Herb of some repute in the Northwest as a winter forage, but of less importance in Western Texas where it is also common, on account of the good quality and abundance of the grass at all seasons.

It is said, by S. Watson, to impart a disagreeable flavor to the meat of cattle fed upon it, and to be used as a remedy in intermittent fever.

Ipomœa Jalapa, Pursh., and **I. Nil**, Roth.

Two species of Morning Glory rather sparingly found in Southern and Southwestern Texas, with thick napiform roots which are more or less cathartic.

PASTURE AND HAY GRASSES OF SOUTH AND WEST TEXAS.

As has already been stated in the first part of this report, the larger part of the State of Texas—that is, about three-fifths of its area—is useless for the purposes of agriculture, but is covered by many species of grasses, which make it excellent pasture-ground. Unfortunately streams and springs are very few, so that immense tracts of luxuriant prairie remain untouched by cattle or sheep on account of the absence of surface water.

The grasses growing on the plains of New Mexico, Arizona, and Western Texas, as well as on the Rocky Mountain plateaus farther north, have acquired a wide reputation "for their rich, nutritious properties, for their ability to withstand the dry seasons, and for the quality

of self-drying or curing, so as to be available for pasturage in the winter."* This property of self-curing is well worthy of consideration. It enables cattle to find ample food during the winter by roaming at freedom, without shelter, over the vast western table-lands, where they are rapidly increasing, taking the place of the nearly extinct buffalo. It renders the raising of sheep particularly remunerative in Arizona and Western Texas, where frost and snow are rare.

According to General Alvord, quoted by Dr. Vasey, grasses are self-cured only on plains and plateaus 3,000 feet or more above sea-level. The Staked Plains and most of the prairie lands west of the Pecos are at or above that elevation, but the greater part of the pasturage east of the Pecos and south of Austin is below it; and yet it can hardly be denied that the grasses of this lower region, even those of Southeastern Texas between the Nueces and the Rio Grande, are also capable of the autumnal drying, which makes them available for winter grazing. On the very coast, two or three hundred feet above sea-level, between San Diego and Corpus Christi, are large herds of cattle and flocks of sheep, which during the winter get no other food than the native grasses of the prairie. It seems, therefore, that elevation, although an ordinary, is not a necessary factor in the process under consideration, and that the degree of atmospheric dryness required for its (perhaps less perfect) accomplishment can exist at low altitudes.

Among the many excellent grasses clothing the vast prairies of South and West Texas the Gramas, owing to their abundance and nutritive qualities, stand pre-eminent. Of the ten species collected the following are most worthy of note:

Common or Blue Grama (*Bouteloua oligostachya*); grows everywhere throughout Texas, wherever grass can fairly grow—in thrifty, dense patches on low prairies, thin and sparse on alkali flats and rocky slopes. It forms a large proportion of the hay delivered at the various military posts and stage stations, and is considered the best obtainable. It cures itself in the most perfect way, so that, although often dead and dry on the parched prairie, it suffers no loss of properties. Analysis (Rothrock, Bot. West of the One Hundredth Meridian) shows that it contains comparatively little water and fiber, a large quantity of sugar or sugar-forming material, fat, and aqueous extract.

Black Grama (*B. hirsuta*); hardly distinguishable from the last in appearance, and equally good; found with it in many places, but in much less abundance.

Tall Grama (*B. racemosa*); grows sparsely with the two preceding species, but is inferior to them in quality.

Many-eared Grama (*B. polystachya*); small, slender grass of good quality, common in thin, scattered bunches on the arid bluffs of the Rio Grande, from El Paso to Eagle Pass and Laredo.

Woolly-jointed Grama (*B. eriopoda*); tall and thrifty, forming dense

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* The Agricultural Grasses of the United States, by Dr. George Vasey.

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and excellent pastures in the Limpio, Guadalupe, and Eagle Mountains, on the Staked Plains, Upper Pecos, Delaware Creek, &c.

Texas Grama (*B. Texana*); small but excellent, common about San Antonio, thence eastward and southward to the coast and the Rio Grande.

B. Humboldtiana, common on the mesas of Eagle Pass and Lower Rio Grande; *B. Havardii*, on the high prairies of Presidio County.

Equal or superior to the Gramas in quality, but less generally distributed, is the famed Buffalo- or Mezquit-Grass (*Buchloë dactyloides*). This invaluable grass, densely tufted and spreading by stolons into broad mats, is the best constituent of sheep pastures. It extends from Northeastern Texas, San Antonio, and Laredo westward to the branches of the Concho. Although hardy and fast spreading, it does not thrive on the dry, sandy plains of the far Southwest, and is rare beyond the Pecos.

A bunch-grass, frequently seen on the bluffs of the Rio Grande and its tributaries, from El Paso to the Great Cañon, with the habit of a Grama, and of excellent quality, is *Cathestechum erectum*, hitherto unnoticed north of the Rio Grande.

From the Concho and Abilene westward to El Paso the most common grass on bottoms and low prairies is *Hilaria mutica*, sometimes called Wire-Grass, which, in the absence of Gramas, affords good grazing for horses and cattle. It forms the bulk of the hay consumed at Camp Rice. Another species of this genus, *H. cenchroides*, a smaller and more delicate grass, grows on the high prairies of Eagle Pass, extending sparingly westward to the prairie district of Marfa.

Common and important is the Red Awned-Grass (*Aristida purpurea*). Under different forms it extends from Dallas, San Antonio, and the Lower Rio Grande to the Rio Concho and the Pecos; thence, in less frequency, over the Staked Plains to El Paso. It forms a large proportion and is one of the best constituents of the hay cut about San Antonio. Another species, *A. dispersa*, is likewise common in the West, but of inferior quality.

The *Pappophorum Wrightii*, which from its hue might be called Purple Grass, is fully the equal of Grama or Buffalo-Grass in nutritive value. I have seen horses and mules turn from green and thrifty Grama to feed on this plant. Unfortunately it is nowhere common; I noticed it on the Pecos and Concho, in the Guadalupe Mountains, and on the broad plains between Alamo Spring and the Hueco Mountains. Another species, *P. vaginatum*, common about Eagle Pass, is a coarser grass.

Less important than the preceding, but also of considerable value, are the following:

Sporobolus airoides, the Salt Grass of the Pecos; grows on all the low

saline prairies of that stream and farther west and north. It purges at first, and may cause severe colic in horses and mules; cattle are but slightly affected, and seem to relish it; it probably affords a useful change of diet.

S. Wrightii, the Maton of the Mexicans, is a tall, coarse grass, growing in large clumps over the Rio Grande bottom. During the winter, in the absence of other grazing, Mexican ponies feed on the Maton, and keep in fair condition. As a hardy perennial grass for saline bottoms, subject to flooding and incapable of cultivation, this plant deserves notice.

Brizopyrum spicatum (Spike-Grass); another salt grass, common on low, marshy places, sometimes affords fair pasturage where hardly any other grass can be found.

Muhlenbergia Texana; abundant on the low, fertile meadows of the West, adding much to the value of pastures.

Andropogon saccharoides and *scoparius* (Beard-Grass); widespread and forming notable constituents of the hay cured in Western Texas, but not considered of very good quality.

Cynodon dactylon (Bermuda-Grass); low and creeping; found mostly along the coast and the Lower Rio Grande; becoming widely introduced and forming most of the lawns in San Antonio; able to withstand heat and drought, and therefore well adapted to dry, sandy soils. It is esteemed a good pasture grass.

Triodia acuminata and var. *monstrosa ; T. pulchella ;* common and widespread, but of inferior quality.

Other grasses highly prized for pasture or hay, and recommended as worthy of propagation on the central and some of the western prairies of Texas, are: Texas Millet (*Panicum Texanum*), spontaneous in the Colorado Valley, where it is much valued, and by many farmers preferred to any other grass; Texas Blue-Grass (*Poa arachnifera*), native on the prairies of the Brazos and the Trinity; in appearance very much like its Kentucky congener, and, it is reported, not inferior to it in quality; Johnson-Grass, or Cuba-Grass (*Sorghum Halapense*), a tall, perennial broom-corn, quick to spread by its root-stocks, very nutritious and productive, yielding three or four crops a year, but most difficult of eradication; Shrader's Grass, also called Johnson Grass at San Antonio (*Bromus unioloides*), a very productive winter grass, of good quality, very hardy on dry prairie, and rapidly spreading on vacant lands about San Antonio.

HEDGE PLANTS OF SOUTH AND WESTERN TEXAS.

In a country where thorny shrubbery abounds we naturally find quite a number of excellent hedge plants, and it is probable that in many places they might advantageously take the place of fences. Hedges can be grown in almost any soil and situation if the right plant

be selected and some care be given to its planting and first growth. Wild seedlings of the proper size, and in sufficient quantity, are always hard to find; it is much better to sow, in a nursery, the seeds of the shrubs selected and raise our own seedlings, which we then can transplant at the most opportune time. This nursery ought to be made in well prepared and manured ground, and freely watered. The following year, the young stems can be transplanted, wherever needed, at the beginning of or during the rainy season; that is, in September in Western Texas, and later east of San Antonio. Transplantation done in the dry season, or without the prospect of several heavy rains to start the plant, would be futile.

Mezquit, as a hedge plant, deserves particular attention. I believe it offers the best chances of success on plains and high prairies. Next in value, in the same situation, I would recommend *Zizyphus obtusifolius* and the several species of *Condalia*. The other native shrubs capable of making good hedges are: *Celtis pallida*, *Castela Nicholsoni*, *Kœberlinia spinosa*, *Prosopis pubescens*, *Acacia Greggii*, *A. Berlandieri*, *A. amentacea*, *A. Wrightii*, *A. Rœmeriana*, *A. Farnesiana*, *Mimosa biuncifera*, *Ceanothus Fendleri*. They have all been already noticed.

SYNOPSIS.

As a useful synopsis, and for convenient reference, the economic plants, already noticed in their proper botanical order, are here grouped according to their several uses and properties, under the following headings:

Used in construction; trees of medium or large size: *Prosopis juliflora*; *Populus monilifera* and *Fremonti*; *Salix nigra* and *amygdaloides*; *Pinus ponderosa* and *flexilis*; *Pseudotsuga Douglasii*; *Quercus virens*, *grisea*, *rubra*, *Emoryi*, *Muhlenbergii*; *Carya olivæformis*; *Ulmus Americana* and *crassifolia*; *Celtis occidentalis*; *Acer grandidentatum*; *Fraxinus viridis* (var. *Berlandieriana*), and *pistaciæfolia*; *Ehretia elliptica*.

Used in cabinet-making, turnery, &c.; trees with hard, colored, close-grained wood: *Prosopis juliflora*; *Acacia Farnesiana*, *flexilis*, *Greggii*; *Sophora secundiflora* and *affinis*; *Juniperus pachyphlœa*; *Juglans rupestris*; *Sapindus marginatus*; *Condalia obovata*; *Celtis pallida*; *Porliera angustifolia*; *Kœberlinia spinosa*; *Cordia Boissieri*.

Used for posts, fencing, fuel; small trees, or stout shrubs: *Prosopis juliflora* and *pubescens*; *Acacia Farnesiana*, *Greggii*, *Wrightii*, *Rœmeriana*, *flexilis*; *Sophora secundiflora* and *affinis*; *Parkinsonia aculeata*; *Salix nigra*, *longifolia*, and *amygdaloides*; *Pinus edulis*; *Juniperus occidentalis* and *flaccida*; *Quercus grisea*, *undulata*, *Durandii*, *stellata*; *Celtis pallida*; *Morus microphylla*; *Ungnadia speciosa*; *Æsculus flava*; *Acer grandidentatum*; *Negundo aceroides*; *Sapindus marginatus*; *Rhamnus Caroliana* and *Purshiana*; *Karwinskia Humboldtiana*; *Fraxinus cuspidata* and *Greggii*; *Forestiera reticulata* and *angustifolia*; *Cordia Boissieri*; *Prunus Americana*, var. *mollis*; *Cratægus subvillosa*; *Larrea Mexicana*; *Por-*

liera angustifolia; Helietta parvifolia; Ptelea trifoliata; Kœberlinia spinosa; Diospyros Texana; Berberis Fremonti; Fouquiera splendens; Arbutus Xalapensis; Bumelia lycioides.

Furnishing edible fruit: *Prosopis juliflora* and *pubescens; Phaseolus retusus; Pinus edulis; Juniperus pachyphlœa; Carya olivæformis; Juglans nigra; Celtis occidentalis* and *pallida; Morus rubra* and *microphylla; Condalia obovata, spathulata, Mexicana; Ehretia elliptica; Cordia Boissieri; Vitis candicans, æstivalis, riparia, rupestris; Prunus Americana,* var. *mollis, P. rivularis* and *Capollin; Rubus trivialis; Capsicum baccatum; Yucca baccata; Helianthus lenticularis; Cereus stramineus, dubius, enneacanthus, dasyacanthus; Echinocactus longehamatus* and *horizonthalonius; Mamillaria meiacantha* and *tuberculosa; Opuntia Engelmanni* and *dulcis; Diospyros Texana; Berberis trifoliata; Cocculus Carolinus; Rivina lævis; Malvaviscus Drummondii.*

Furnishing esculent parts other than the fruit: *Psoralea esculenta; Hoffmanseggia stricta; Peteria scoparia; Dasylirion Texanum; Agave Wislizeni* and *Americana; Opuntia Engelmanni; Apodanthera undulata; Talinum aurantiacum; Nasturtium officinale.*

Yielding sap, gum, or alcoholic liquor: *Prosopis juliflora; Negundo aceroides; Dasylirion Texanum; Yucca baccata; Agave Americana* and *Wislizeni; Juniperus pachyphlœa.*

Textile plants: *Yucca baccata; Agave heteracantha, Americana, Siselana.*

Amole or soap plants: *Yucca baccata* and *angustifolia; Agave heteracantha; Sapindus marginatus.*

Poisonous plants: *Sophora secundiflora; Astragalus mollissimus; Oxytropis Lamberti; Ungnadia speciosa; Karwinskia Humboldtiana; Rhus Toxicodendron; Vitis incisa; Apodanthera undulata; Engelmannia pinnatifida; Lantana Camara.*

Dye plants: *Sophora secundiflora; Condalia obovata; Vitis incisa; Larrea Mexicana; Krameria canescens; Diospyros Texana; Rumex hymenosepalus.*

Tea and coffee plants: *Sesbania cavanillesii; Acacia flexilis; Croton corybulosus* and *suaveolens; Bidens Bigelovii; Salvia ballotæflora; Hedeoma Drummondi.*

Antidotes against the bites of venomous animals: *Euphorbia albomarginata, stictospora, cinerascens* (var. *appendiculata*); *Calophanes linearis.*

Tannin plants: *Prosopis juliflora; Acacia Farnesiana; Rhus copallina; Krameria lanceolata, parvifolia, canescens; Rumex hymenosepalus; Eriogonum longifolium.*

Perfume plants: *Acacia Farnesiana* and *flexilis; Pectis angustifolia, longipes, papposa; Actinella odorata; Lippia lycioides.*

Medicinal plants: *Acacia Farnesiana; Parkinsonia aculeata; Ephedra antisyphilitica* and *trifurca; Cordia Boissieri; Solanum elæagnifolium; Nicotiana glauca; Mozinna spatulata; Jatropha macrorhiza; Acalypha*

Lindheimeri; Larrea Mexicana; Porliera angustifolia; Xanthoxylum Clava-Herculis and *Pterota; Castela erecta; Agave Wislizeni; Opuntia Engelmanni; Anhalonium fissuratum; Cucurbita perennis; Krameria canescens, lanceolata, parvifolia; Grindelia squarrosa; Parthenium hysterophorus; Hymenatherum gnaphaliopsis; Chrysactinia Mexicana; Chilopsis saligna; Eurotia lanata; Ipomœa Jalapa* and *Nil.*

Ornamental trees and shrubs: *Acacia Farnesiana* and *constricta; Sophora secundiflora* and *affinis; Parkinsonia aculeata* and *Texana; Sesbania Cavanillesii; Cassia Wislizeni; Leucophyllum Texanum* and *minus; Pentstemon baccharifolius; Morus rubra; Fraxinus pistaciæfolia; Porliera angustifolia; Chilopsis saligna; Tecoma stans; Salvia regla; Nicotiana glauca; Berberis trifoliata; Fouquiera splendens; Buddleia marrubiifolia; Yucca baccata* and *angustifolia.*

Pasture and hay grasses: See special section under this heading.

Hedge plants: See special section under this heading.

Forage plants, not grasses: *Prosopis juliflora* and *pubescens; Pithecolobium brevifolium; Opuntia Engelmanni* and others; *Eurotia lanata.*

Miscellaneous: *Prosopis juliflora; Parkinsonia Texana; Rhus virens; Solanum elæagnifolium; Mozinna spathulata; Nolina Texana; Opuntia Engelmanni; Anhalonium fissuratum; Cucurbita perennis; Martynia fragrans; Sabal Palmetto.*

NOTES ON THE MOLLUSKS OF THE VICINITY OF SAN DIEGO, CAL., AND TODOS SANTOS BAY, LOWER CALIFORNIA.

By CHARLES R. ORCUTT,* with comments by W. H. DALL.

During the past few years I have made extensive collections, mainly of littoral shells, in this vicinity, and have had opportunity for making hasty notes and collections while botanizing on the shores of All Saints (Todos Santos) Bay, situated about 50 miles south of San Diego. From material collected, the marine fauna of San Diego appears to possess a larger number of the species of the Lower Californian coast than of the Californian province to the north, while few species can be considered as locally characteristic with our present knowledge of their distribution.

San Diego Bay is protected on the west by a high promontory, Point Loma, with a rocky ocean beach and a shingle beach by the entrance to the harbor. Inside of the entrance is an extensive bed of clay and boulders at what is known as La Playa, and this station forms the principal home of the pholads, rock pectens (*Hinnites gigantea* Gray), and other shells not elsewhere found abundantly. The bay is protected on the southwest by a low, narrow peninsula, with a hard, sandy ocean beach, and sand or mud on the bay side. North of San Diego Bay lies a large lagoon known as False Bay, which possesses extensive muddy flats and a narrow peninsula of sand dunes on the west. Inside of this bar is a stretch of rocky beach, famous as a clam bed, and to this reference is usually made when False Bay is mentioned. North of the ocean side of this peninsula the beach is similar to that on the west of Point Loma, rocky pools with irregular stretches of flat or broken boulders partially imbedded in shell sand, beneath which a rich harvest of small species may be anticipated.

Todos Santos (or All Saints) Bay is unprotected from the surf, and on the north and south possesses rocky beaches, between which on the east lies about 20 miles of hard, sandy beach, poor in living shells. The north beach is of a volcanic formation, while on the south it is largely composed of fossil shells, of which there is an immense deposit. When the station is not mentioned, the species has been found at both San Diego and on Todos Santos Bay. The determinations have largely been made or verified by George W. Tryon, jr., of Philadelphia, and William H. Dall, of Washington, to whom I am greatly indebted. Specimens of the more interesting species have been contributed to the United States National Museum and the Museum of the Academy of Natural Sciences at Philadelphia.

* The specific nomenclature of this paper has been revised by Mr. W. H. Dall at Mr. Orcutt's request; the rarer species have been examined, and several doubtful species have been determined by Mr. Dall from the types in the National Museum. Occasional notes in brackets have also been added by Mr. Dall.

CEPHALOPODA.

Octopus punctatus Gabb.

Common on rocky beaches.

GASTROPODA.

Murex trialatus Sby.

Rocky beaches, rare at San Diego, more common south. Varies in color from pure white to brown, often banded.

Cerostoma nuttallii Conr.

Rocky beaches, abundant and very variable in form and color. The pure white, olivaceous, banded and brown varieties are distinctly and prettily marked. Also at Todos Santos Bay.

Muricidea barbarensis Gabb.

A very large and old specimen of this was found on the ocean side of Point Loma, inhabited by a hermit crab.

Muricidea incisa Brod.

Rare, occasionally found near low-water mark.

Pteronotus festivus Hinds.

Abundant at False Bay, La Playa, and Todos Santos Bay, among small, angular boulders.

Ocinebra subangulata Stearns.

A live individual washed ashore on a piece of kelp, found on the ocean side of the San Diego peninsula, is now in the collection of the Phil. Acad. Sci.

Ocinebra interfossa Cpr.

Under rocks partially imbedded in shell sand, rocky beaches, with the following species:

Ocinebra gracillima Stearns.

Under stones, on stony beaches. San Diego.

Ocinebra interlirata Stearns.

San Diego. Rare.

Ocinebra poulsonii Nutt.

Equally abundant and in similar situations with *Pteronotus festivus*, Hds. Also at Todos Santos Bay.

Purpura saxicola Val.

Abundant on a rocky beach just south of the boundary line, but not noticed on other ocean beaches either at San Diego or All Saints Bay.

Purpura biserialis Blainv.

A single living specimen from the beach north of False Bay, near La Hoya.

[This is the most northern locality known for this species. The specimen is large and fine. D.]

Monoceros lugubre Sby.

Abundant at Todos Santos Bay and north to near the United States line. Light-colored individuals were found of a shade of yellow ochre, merging to white.

Monoceros engonatum Conr.

Abundant on exposed shingle beaches.

Monoceros pauciliratum Stearns.

Exposed shingle beaches. Also at Todos Santos Bay.

[This species forms the link between the two preceding species. D.]

Monoceros engonatum var. **spiratum** Blainv.

More common on sheltered rocky beaches.

Chorus belcheri Hds.

Formerly abundant at San Diego (during the early whale fisheries), where it is now rare. Common at Todos Santos Bay.

Ranella californica Hds.

Very abundant in January, when it comes into sheltered places for breeding. Its favorite ground is on the sandy beach inside of the False Bay peninsula, where it finds abundant food, preying on *Echinarachnius excentricus*, *Renilla amethystina*, etc. The dead shells of this, *Chorus Belcheri* and *Siphonalia Kellettii* are washed up in great numbers at Todos Santos Bay.

Fusus kobelti Dall, var. **unicolor.**

One specimen. San Diego.

[It differs from the type in being more slender and in the absence of the usual chocolate color on the larger riblets. D.]

Siphonalia kellettii Fbs.

Very rare at San Diego, apparently abundant at Todos Santos Bay, where large numbers of dead shells are washed ashore.

[Dredged alive in 16 fathoms off Catalina Island Harbor in 1873. D.]

Macron lividus A. Ad.

Not rare near low water; ocean beaches. Also Todos Santos Bay.

Nassa fossata Gould.

Dead shells of this and the following abundant, apparently common in deep water.

Nassa perpinguis, Hinds.

San Diego. Also at Todos Santos Bay.

[Not rare at Catalina in 16 fathoms. D.]

Nassa mendica var. **cooperi** Fbs.

Rare at low water at La Playa, also at Todos Santos Bay.

Nassa tegula Rve.

Abundant on muddy bay shores.

Mitra maura Swains.

Dead shells often washed ashore on the ocean beaches.

Erato vitellina Hds.

Not common.

Erato columbella Mke.

False Bay and La Playa. Rare.

Marginella regularis Cpr.

San Diego. Not rare.

Marginella subtrigona Cpr.

San Diego. Rare.

Volutella pyriformis Cpr.

On sea-grass, probably abundant, San Diego Bay.

Volvarina varia Sby.

Common beneath rocks partially imbedded in shell sand, ocean beaches.

Olivella biplicata Sby.

Abundant on sandy ocean beaches about May. Pure white and, more rarely, black individuals may be found.

Olivella bœtica Cpr.

Abundant on sandy beaches at False Bay and elsewhere in May.

Columbella fuscata Sby.

One specimen found on sea-grass at San Diego.

Columbella (Astyris) carinata Hds., and var. **Hindsii** Rve.

Found abundantly on sea-grass during the spring. Very variable in form and coloring.

Columbella (Astyris) tuberosa Cpr.

Dead specimens abundant; not found alive.

Amphissa versicolor Dall.

Not rare, with *Volvarina varia*, Sby.

Anachis subturrita Cpr.

Found among oyster shells from an old pile below low-water mark.

Myurella simplex Cpr.

Abundant at low water on the sandy shores of San Diego Bay.

Surcula carpenteriana Gabb.

Todos Santos Bay, dead on beach.

Drillia moesta Cpr.

Abundant in the spring at La Playa and elsewhere. Also at Todos Santos Bay.

Drillia inermis Cpr.

Specimens occasionally found at low water, but apparently common in deeper water.

Mangilia angulata Cpr.

Not common; sandy beach at La Playa, with *Cylichna inculta* Gld.

Mitromorpha filosa Cpr.

Under boulders imbedded in shell sand, ocean beaches, near low-water mark; rare. Also at Todos Santos Bay.

Conus californicus Hds.

Abundant on sandy beaches at La Playa, False Bay, and elsewhere during the spring.

Cypræa spadicea Gray.

This beautiful shell was found abundant at False Bay during April and May at very low water, but elsewhere and at other times only dead specimens have been found. From beach-worn specimens it appears

more common south and to attain a larger size than those found living at San Diego.

[Very large dead specimens were found on beach at Catalina Island on the side of the isthmus opposite the harbor. D.]

Trivia californica Gray.

Dead specimens of this are not uncommon, but I have not found it living.

Trivia solandri Gray.

Rare; living specimens have been found at La Playa and False Bay during the spring tides. Dead specimens not rare at Todos Santos Bay.

Lunatia lewisii Gld.

Rare; apparently common in deep water and farther south.

Neverita recluziana Petit.

Not rare on bay shores, at very low water, especially during the spring.

Sigaretus debilis Gld.

I have a single broken individual from San Diego, and another from Todos Santos Bay.

Lamellaria diegoënsis Dall, n. s., Pl. XXIV, figs. 1–3.

False Bay at low water, April and May; rare. When living the soft parts completely cover the shell and are, in part, of a vivid red color similar to that of *Doris sanguinea.*

[Soft parts as contracted in alcohol about .65 inch in length, above smooth or nearly so, dull white or grayish, beneath lighter colored; form rounded oval, a well-marked notch in the mantle edge (notaeum) a little to the left of the middle line in front; foot rather large, rounded behind, nearly transversely truncate in front with rounded corners and the front margin deeply grooved or double; head dark gray above, flattened; tentacles obtusely tapering, somewhat flattened; eyes large and black, on tubercles outside of the bases of the tentacles; mouth hidden under the head, small; verge extremely large, broad, flattened extending forward beyond the head, curved to the left in a broad ascending spiral; smooth below, granulous above with a short line of elevated papillæ inside the edge of the outer part; beyond the curve is an indentation on the left side behind which is a stout conical papilla from the apex of which extends upward a slowly tapering cylindro-conic tubular portion; the nuchal cavity is prolonged backward under the anterior edge of the immersed shell; shell calcareous except the immediate margins of the aperture, grayish waxen white, slightly iridescent with a mucilaginous polish like dry glue inside and out, somewhat malleated, with indications of the lines of growth by obscure slightly elevated transverse waves and faint irregular spiral tracings; three-whorled, very much inflated, though the form varies slightly between individuals and probably between the sexes; nucleus small, smooth; suture deep, not channeled; spire pervious from below; columella less

calcareous than the shell in general, without callus or any thickening, twisted into an open spiral, continuous with the outer lip in front only; aperture very oblique, subquadrate. Alt. 15; max. lat., 17; long. of aperture, 12; lat. of aperture, 10^{mm}.

This shell was first received from Mr. Henry Hemphill at San Diego; subsequently other specimens came to hand from Cape St. Lucas. As will be seen from the characters of the soft parts, it is a true *Lamellaria* (*Marsenia*, Leach, is a later and synonymous name). It is more inflated and elevated than any European or West American form known to me.

Lamellaria stearnsii Dall (1871) is a depressed and much more calcareous species, which has the soft parts translucent white, and the shell distinctly finely striated. *Lamellaria rhombica* Dall proves to be a *Marsenina*, though the shell does not greatly differ from that of *L. stearnsii*, and should take the name of *Marsenina rhombica.* The two forms of *L. stearnsii*, one of which was described as a variety *orbiculata*, may turn out to be only sexually distinct, as the differences are such as mark the two sexes of the common British species according to Jeffreys. Both the just mentioned forms, as well as *Marsenina rhombica*, were collected at Monterey; while *L. diegoensis* seems to belong to the southern fauna. D.]

Crucibulum spinosum Sby.

Common rocks and shells along bay shores.

Crepidula adunca Sby.

Not rare on *Norrisia Norrisii.*

Crepidula rugosa Nutt.

Abundant on *Pecten æquisulcatus* and other shells and stones in San Diego Bay, Todos Santos Bay and elsewhere.

Crepidula navicelloides Nutt.

Abundant in the interior of dead univalves, varying in size according to the shell occupied.

In dead bivalves assuming the form *nummaria* Gould.

Crepidula dorsata var **lingulata** Gld.

Abundant on rocks at La Playa and elsewhere. Very variable in form, but well marked by the form of the deck.

Hipponyx tumens Cpr.

Abundant with the next species.

Hipponyx antiquatus L., var. **serratus** Cpr.

Abundant under stones or shelving rocks, ocean beaches.

Scalaria hindsii Cpr. and var. **subcoronata.**

Not common.

Scalaria indianorum Cpr.

Not rare; San Diego.

Scalaria bellastriata Cpr.

Very rare. San Diego.

Opalia crenatoides Cpr.
San Diego; not common. Also Todos Santos Bay.

Ianthina bifida Totten.
Specimens often washed ashore at San Diego.

Odostomia nuciformis Cpr. var. **avellana** Cpr.
San Diego.

Odostomia inflata Cpr.
San Diego; not rare. Also a variety (?) more slender and elevated proportionally, but otherwise similar.

Odostomia æquisculpta Cpr.
Abundant on the shells of *Haliotis*.
[San Diego to Cape St. Lucas. D.]

Turbonilla torquata Gld.
Abundant on the shells of *Haliotis*.

Turbonilla aurantia Cpr.
San Diego.

Chrysallida pumila Cpr.
[Rare. Todos Santos. D.]

Obeliscus variegatus Cpr.
San Diego Bay; dead specimen; rare.

Litorina planaxis Phil.
Abundant.

Litorina scutulata Gld.
More abundant than the above in sheltered places.
[Also var. *L. plena* Gld. very large and fine. D.]

Lacuna variegata Cpr.
On sea-grass; abundant in the spring.

Lacuna unifasciata Cpr.
San Diego. Not common.

Rissoina interfossa Cpr.
[Todos Santos. D.]

Isapis fenestrata Cpr.
Specimens from among oyster shells below low water, off an old pile from San Diego Bay. Also Todos Santos Bay.

Mesalia tenuisculpta Cpr.
San Diego.

Bittium quadrifilatum Cpr.
San Diego.

Bittium armillatum Cpr.
Abundant on sponges found during the spring on muddy flats, San Diego Bay, at low water; dead ones abundant among worn shells.

Cerithiopsis assimilata C. B. Adams.
San Diego. Not found alive.

Cerithidea sacrata Gld.
Abundant in salt marshes and on muddy flats.

Cæcum californicum Dall.

Cæcum Cooperi Cpr. Suppl. Rep. Br. As. 1864, p. 655, *not*

Cæcum Cooperi Smith, Ann. Lyc. Nat. Hist. N. Y., pp. 154, 168. 1862.

San Diego. Cooper.

[The above synonymy shows that of the two species named *C. Cooperi*, that of Mr. Sanderson Smith has priority, and consequently the Californian species is the one which must take a new name instead of the New York form. Through a failure to observe this Dr. Cooper fell into the error of renaming *C. Cooperi* (New York) as *C. Smithii* (Proc. Phil. Acad. Nat. Sci. 1872, p. 154). D.]

Cæcum orcutti Dall, n. s.

[Shell small, stout, smooth, but not polished, light warm brown in color and without sculpture, except very slight lines of growth. Shell slightly curved, the anterior aperture very oblique, about at right angles to the plane of the diameter of the plug, the superior margin being the anterior; plug glandiform, smooth, rounded without mucro; operculum brown, thin, smooth. Lon. of shell, 2.00; diameter 0.75^{mm}.

San Diego, Orcutt, abundantly, under stones.

This is the smallest and the only smooth Californian species of the genus. D.]

Jeffreysia translucens Cpr.

One specimen, San Diego.

Barleeia subtenuis Cpr.

Very abundant in the spring on sea-grass; also var. *rimata*, Cpr.

[Very frequently with a small *Spirorbis* growing on it larger than the shell. D.]

Barleeia haliotiphila Cpr.

San Diego. Rare.

Bithinella binneyi Tryon.

Freshwater springs at Campo, San Diego County, California.

Bithinella intermedia Tryon.

Freshwater springs on Cuyamaca Mountain, at a higher altitude than the last.

Truncatella californica Pfr.

Abundant.

Truncatella stimpsonii Stearns.

Found this species in considerable numbers in company with *Pedipes unisulcatus*, on and under smoothly-worn bowlders in caves on the ocean beach north of False Bay, near high-water mark.

Phasianella compta Gld.

Thousands found in sea-grass on the inside of San Diego peninsula in November, 1881. Usually incrusted with a small polyzoan (*Defrancia intricata*).

[The operculum is white, prettily clouded with dark green. D.]

Eucosmia substriata Cpr.

[Rare, San Diego, Dall. Catalina Island, rare, Cooper.]

Pomaulax undosus Wood.

Common.

Liotia acuticostata Cpr.

San Diego. Rare.

Omphalius fuscescens Phil.

Abundant on rocky beaches. Also Todos Santos Bay.

Omphalius aureotinctus Fbs.

Rocky ocean beaches. Not rare.

Chlorostoma funebrale A. Ad.

Common on shingle beaches.

Chlorostoma gallina Fbs.

Rocky ocean beaches; abundant. Also Todos Santos Bay. The young are sometimes of a brick-red color.

Chlorostoma brunnea Phil.

One from a shingle beach at Todos Santos Bay.

Chlorostoma pfeifferi Phil.

One dead specimen from San Diego.

Norrisia norrisii Sby.

Abundant on kelp along the coast.

Calliostoma canaliculatum Mart.

On kelp, specimens are rarely washed ashore.

Calliostoma annulatum Mart.

I have one specimen from from a San Diego beach.

Calliostoma costatum Mart.

Not often washed ashore.

Calliostoma gemmulatum Cpr.

Often washed ashore at San Diego and Todos Santos Bay.

Leptothyra bacula Cpr.

Abundant under rocks along the ocean beaches.

Leptothyra paucilirata Dall.

Rare.

[Specimens sent were of a magnificent crimson color. D.]

Leptothyra sanguinea var. **lurida** Dall.

Less common than the last.

[This form has a dull olivaceous cast sometimes mottled with whitish. The sculpture is more compact and closer, the nacre less brilliant than that of Monterey specimens; they are also smaller on the average. D.]

Haliotis assimilis Dall.

Numerous dead specimens are washed ashore at the boundary beach from deep water.

Haliotis cracherodii Leach.

Abundant at common low water on rocky beaches; very variable. Also Todos Santos Bay.

Haliotis splendens Rve.

Numerous at very low water on ocean beaches beneath bowlders. Collected extensively by the Indians on Todos Santos Bay during the spring.

Haliotis corrugata Gray.

Apparently a deeper water species; not common.

Ethalia supravallata Cpr.

San Diego. Not rare.

Fissurella volcano Rve.

This is found larger and more numerous at Todos Santos Bay than in the vicinity of San Diego, where it is also abundant.

Fissurella (Glyphis) aspera Esch.

Not common. San Diego.

Fissurella (Glyphis) murina Cpr.

Not common. San Diego.

[This is the *Glyphis densiclathrata* of Californian conchologists, and for a time of Carpenter, but not of Reeve. D.]

Lucapina crenulata Sby.

This great species is not rarely found on the rocky ocean beaches, in pools, or among the sea-grass with *Aplysia Californica* Cp.

[Very young specimens are of a lurid pink. D.]

Fissurellidæa bimaculata Dall.

San Diego. Rare.

Clypidella (?) callomarginata Cpr.

Not common.

[It is not certain that this is a *Clypidella*. D.]

Acmæa mitra Esch.

Deep water; dead shells frequent.

Acmæa insessa Hinds.

On algæ.

Acmæa persona Esch.

Abundant and very variable in form and color.

Acmæa pelta Esch. var.

A small elevated form is found beneath small stones imbedded in sand near high-water mark on the shores of San Diego Bay. It is found in company with *Chiton dentiens*, Gld. and is not rare.

Acmæa asmi Midd.

This very elevated little shell is found abundant on the shells of *Chlorostoma funebrale*, which it closely resembles in color.

Acmæa spectrum Nutt.

An abundant species, very variable in form.

Acmæa patina var. **cumingii** Rve.

Less abundant than the other species.

[This is nearly the southern limit of this form. D.]

Acmæa scabra Nutt.

The more common species at San Diego, also found at Todos Santos Bay.

[Sometimes beautifully mottled like *pintadina* Gld. D.]

Acmæa paleacea Gld.

Common on sea-grass outside the harbor at San Diego, and also found at Todos Santos Bay.

Acmæa depicta Hds.

On sea-grass; not rare.

CHITONIDÆ

Chiton (Leptochiton) nexus Cpr.

San Diego.

Chiton (Trachydermon) dentiens Gld.

With *Acmæa pelta*, var.

San Diego. [*T. pseudodentiens* Cpr. D.]

Chiton (Callochiton) fimbriatus Cpr.

San Diego, Catalina Island.

Chiton (Chætopleura) hartwegii Cpr.

This with the two following are the more common species.

Chiton (Maugerella) conspicua Cpr.

Abundant beneath bowlders on shingle beaches.

Chiton (Stenoradsia) magdalenensis Hds.

Beneath bowlders at False Bay; not rare.

Chiton (Pallochiton) lanuginosa (Cpr.) Dall, 1878.

[*Hemphillia lanuginosa* Cpr. MSS. The generic name was already preoccupied in *Limacidæ*. D.]

Chiton (Lepidopleurus ?) pectinulatus Cpr.

San Diego.

Chiton (Callistochiton) decoratus Cpr.

San Diego.

Chiton (Nuttallina) scabra Reeve.

San Diego.

Chiton (Mopalia) ciliata H. & A. Ad.

Chiton (Mopalia) lignosa Gld. var. **acuta** Cpr.

OPISTHOBRANCHIA.

Philine, species indet.

Flats on shores of San Diego Bay, with *Haminea vesicula*.

Atys nonscripta A. Ad.

Rare at San Diego.

Tornatella punctocælata Cpr.

Not common.

Cylichna inculta Gld.

Abundant on the sandy shores of San Diego Bay.

Tornatina eximia Baird.

San Diego Bay.

[Described from Vancouver. D.]

Bulla nebulosa Gld.

Plentiful on muddy flats in spring.

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Haminea (hydatis ? var.) vesicula Gld.

Sandy bay shores, common, transparent. Also at La Playa, among rocks, a beautiful pink form.

Haminea virescens Sby.

In crevices of rocks and interior of rock pools, abundant.

Aplysia californica Cooper.

Ocean beaches among sea-grass or in rock pools.

Doris sanguinea Cooper.

Under rocks, San Diego; rare.

[NOTE.—The identifications of these nudibranchs are partly provisional in the absence of typically named specimens or figures. D.]

Doris (Archidoris) montereyensis (Cooper) Bergh.

San Diego; common.

Doris alabastrina Cooper.

San Diego.

Doris albopunctata Cooper.

San Diego.

Doris (Diaulula) sandiegensis (Cp.) Bergh.

Common, under rocks.

Chromodoris californiensis Bergh.

San Diego; rare. [D.]

PULMONATA.

Melampus olivaceus Cpr.

Abundant in salt marshes.

Pedipes liratus Binney.

San Diego; rare. [D.]

Pedipes unisulcatus Cpr.

With *Truncatella Stimpsonii*, Stearns (alive) and at Todos Santos Bay.

Gadinia reticulata Sby.

Common beneath shelving rocks on ocean beaches.

ACEPHALA.

Zirphæa crispata Linné.

La Playa; not abundant.

Netastomella darwinii Sby.

Numerous in small bowlders, La Playa.

Parapholas californica Conr.

La Playa; abundant.

Penitella penita Conr.

La Playa.

Martesia intercalata Cpr.

Todos Santos Bay imbedded in shells of *Haliotis*.

Solen rosaceus Gld.

Somewhat abundant at San Diego; also at Todos Santos Bay.

Solecurtus californianus Conr.

Abundant, with the less common variety *subteres*.

[Very close to the eastern species. D.]

Siliqua lucida Conr.

Several examples have been found on the sandy ocean beaches at San Diego and Todos Santos Bay.

[This seems to be a valid species, though closely allied to *S. patula*. D.]

Platyodon cancellata Conr.

Abundant at La Playa where they have been collected for food, but the animal is bitter. Also Todos Santos Bay, but not found alive.

Saxicava rugosa Linn.

Young specimens not rarely found among the roots of kelp when washed ashore by a storm.

Corbula luteola Cpr.

Common beneath stones on the ocean beaches that are partially imbedded in shell sand.

Corbula sp. indet.

San Diego and Todos Santos Bay.

[A very thin species, resembling a *Eucharis;* perhaps from Southern fauna. D.]

Cryptomya californica Conr.

Not rare.

Schizothaerus nuttallii Conr.

San Diego; Todos Santos Bay.

Pandora (Clidiophora) punctata Cpr.

Single valves often washed ashore on sandy beaches.

Thracia curta Conr.

Not rarely found imbedded in rocks; San Diego.

Thracia plicata ? Desh.

Numerous dead shells of this are washed up on the shores of San Diego Bay, with *Lyonsia Californica* and other bivalves.

[Described from Southern fauna, but in absence of a larger series the identification is not dogmatic. D.]

Periploma argentaria Conr.

Single valves only found; not common.

Lyonsia californica Conr.

Often washed ashore in great numbers on the bay shores.

Entodesma scammonii Dall.

One example found with the above species.

Mactra planulata Conr.

Ocean beaches; not found abundantly. Also Todos Santos Bay.

Mactra falcata Gld.

Not found abundantly.

[Belongs to Northern fauna. D.]

Semele decisa Conr.

This species, with *Psammobia rubroradiata*, *Saxidomus aratus* and *nuttallii*, *Tapes staminea*, and other bivalves are collected commonly at

False Bay, where they are found imbedded in a coarse deposit of gravel, boulders, and shells that forms a rich ground for marine life. These species are also found, in less quantity, at La Playa, and dead examples indicate their existence at Todos Santos Bay.

Semele rupium Sby.

This abounds on the rocky ocean beaches, but rarely collected alive.

Lutricola alta Conr.

Not plentiful.

Œdalina subdiaphana Cpr.

Bay shores; abundant.

Cooperella scintillæformis Cpr.

With the last; rarer.

Cumingia californica Conr.

La Playa; abundant in dead bivalves or in holes. Todos Santos Bay.

Psammobia rubroradiata Nutt.

Common at False Bay; apparently rare elsewhere.

[Also found at Avatcha Bay, Kamchatka, by me. D.]

Sanguinolaria Nuttallii Conr.

Seemingly plentiful by the quantity of dead examples found on bay shores.

Tellina Bodegensis Hds.

Not plentiful; San Diego.

Tellina Gouldii Hanl.

Abundant; San Diego Bay. Also Todos Santos Bay.

Tellina (Moera) variegata Cpr.

San Diego Bay; fine.

Tellina (Heterodonax) bimaculata Linné.

Abundant along the whole coast.

Macoma secta Conr.

Plentiful at times, as also the two following:

Macoma indentata Cpr.

Macoma inquinata Desh.

Donax californicus Conr.

Abundant on sandy ocean beaches.

Donax flexuosus Gld.

Rarely collected; San Diego.

Petricola carditoides Conr.

San Diego; not numerous; burrows in soft rock the length of its shell.

Saxidomus nuttallii Conr.

Collected for food and rather abundant in places.

[The distinction between this and the following form is often hardly specific. D.]

Saxidomus aratus Gld.

Found with the above and about equally plentiful.

Venus (Chione) fluctifraga Sby.

The common cockle; often collected for food, and excellent quality. This and the two following species, which are less abundant, are often pearl-bearers:

Venus (Chione) succincta Val.

San Diego.

Venus (Chione) simillima Sby.

San Diego.

Tivela crassatelloides Conr.

A market clam but not in very plentiful supply. This is sometimes pearl-bearing.

Cytherea undato-striata Cpr.

Dead valves only have been found of this; San Diego Bay.

Cytherea (Amiantis) callosa Conr.

This beautiful species is rarely found at San Diego, but is abundant on Todos Santos Bay, where it burrows in the hard, sandy beach to a depth of about a foot near very low-water mark, where it is easily obtained for the market by Indians whenever it may be in demand.

Tapes staminea Conr.

Tapes staminea Conr. var. **tumida** Sby.

San Diego.

Tapes staminea Conr. var. **diversa** Sby.

San Diego and Todos Santos Bay.

Tapes laciniata Cpr.

San Diego and Todos Santos Bay.

Cardium quadragenarium Conr.

La Playa; rare. Odd valves abundant at Todos Santos Bay.

Liocardium elatum Sby.

Not rare, below low-water mark on the muddy flats of San Diego and False Bays. Also Todos Santos Bay.

Liocardium substriatum Conr.

Abundant with the last.

Chama exogyra Conr.

Abundant on all rocky beaches at low water.

Chama spinosa Sby.

Less abundant, frequenting deeper water.

Lucina nuttallii Conr.

San Diego.

Lucina californica Conr.

San Diego.

Diplodonta orbella Gld.

Found in holes in rocks or in dead bivalves at La Playa; not rare. Also Todos Santos Bay. A single example of a much flatter species was found at San Diego, which is now in the collection of the Philadelphia Academy of Sciences.

Tellimya tumida Cpr.

San Diego; not found abundantly.

Lasea rubra Mont.

Found in great numbers near high-water mark attached to the byssus of *Mytilus*, in crevices, dead barnacles, and shells, or among small stones. Also at Todos Santos Bay.

Kellia laperousii Desh.

In dead shells or among rocks; not rare.

Chlamydoconcha orcutti Dall.

False Bay, under stones.

[I had intended to have subjoined a complete account, with figures, of this singular form, but have been obliged to defer it on account of the pressure of official duties. See *Science*, vol. iv, p. 50, July 18, 1884. D.]

Leda cælata Hds.

Odd valves occasionally washed ashore.

Yoldia cooperi Gabb.

A single valve found on the ocean beach north of False Bay.

Arca (Barbatia) gradata Sby.

Abundant under stones at low water.

Cardita (Carditamera) subquadrata Cpr.

With the above, but not common.

Milneria minima Dall. Pl. XXIV, figs. 5–7.

Ceropsis minima Dall, Am. Journ. Conch., vii, p. 152, pl. 16, figs. 5, 6, 1871. (Generic name preoccupied.)

Milneria minima Dall, Am. Naturalist, Sept., 1881, p. 718.

[This curious little member of the *Carditidæ* was discovered in 1866 by the writer and found nestling on the backs of *Haliotis*, which afford a shelter for many small mollusks. The first specimens came from Monterey; it was afterward found at Catalina Island, and Mr. Orcutt now sends it from San Diego and Todos Santos Bay; some specimens from the last locality reach 7.50^{mm} in length and 6.00 in greatest breadtn.

While examining some dry specimens sent by Mr. Henry Hemphill from San Diego some years since a very interesting feature was discovered which may be briefly described as follows:

Milneria is diœcious like most lamellibranchs, and there is quite a difference in average size and proportional breadth, the male shell being always a little smaller and narrower than a female specimen of the same length. Both attach themselves to surrounding objects by a small byssus, for the passage of which a very slight gape exists between the ventral edges of the valves. The ventral surface when the valves are closed is nearly flat, an arrangement which has been brought about by the needs of the creature settling like some *Arcas* on a plane surface like a flat stone or *Haliotis* back. The male has the base or ventral surface a little striated. In the female, however, a much more elaborate arrangement is found. We have in fact a proper marsupium.

The center of the base behind the byssal fissure is pushed upward into a little dome nearly equally participated in by each valve. The edges of the valves in the arch of the dome do not quite come together, so that the mantle is produced on each side, lining the dome and closing in below it, thus forming an approximately hemispherical membranous sac, which separates into two halves when the valves open, is protected by the shelly dome above and by the flat surface of the stone (or shell upon which the parent rests) below. In this snug retreat it is probable the eggs are retained until hatched and the young for an indefinite period. The marsupium in all the specimens examined was well filled with young fry which had passed the embryonic stages.

A matter of interest connected with this discovery is the evidence it shows of the process by which the more complicated marsupium of *Thecalia concamerata* Ad. (see pl. xxiv, fig. 8) was formed. Hitherto the latter, as far as I recall at present, has been the only lamellibranch known in which the outer shell has been folded in to form a marsupium. In *Milneria* the outer layers of the shell within the dome remain, and even the epidermis seems to persist, indicating that after the young have left their shelter the enfolding processes of the mantle may be withdrawn into the body of the shell. In *Thecalia*, on the contrary, the base of the dome has become closed by the fusing of the outer layers of the shell, the interior of the dome, which has become altered in the process to a double funnel (one in each valve) is permanently covered by the mantle and secreted by those parts which produce only the inner layer of the valves, neither the outer nor the epidermal layers any longer taking part in its formation. The line of fusion from the two sides is plainly marked on the outside of the shell of the female *Thecalia*, the male, as in *Milneria*, being of the ordinary form. Both genera belong to the *Carditidæ*, and it is difficult not to conclude that in the two forms we have the early and the completed stages of a process which has for its end the safety of the immature individuals of the species.

I have written as if the function of the marsupium in *Thecalia* was certain; and indeed I was informed by the late Dr. William Stimpson that during his dredgings at the Cape of Good Hope he had discovered the eggs in the internal funnels of the female shell. This has always been surmised, but the fact of its having been actually observed has, I believe, not hitherto been made public in print. The specimen figured is one received from Dr. Stimpson in 1865. The interest attaching to the study of the reproductive stages in either species can hardly be overestimated, and the attention of observers at the Cape and in California is hereby respectfully called to the matter. Either species would probably do well in an aquarium. D.]

Mytilus californianus Conr.

Abundant.

Mytilus edulis Linné.

San Diego Bay; not numerous, probably introduced.

Mytilus bifurcatus Stearns.

Abundant near high-water mark all along the coast.

Modiola capax Conr.

Abundant, especially at False Bay and similar locations.

Modiola recta Conr.

False Bay; rare.

Modiolaria denticulata Dall.

San Diego (young).

Adula falcata Gld.

La Playa and elsewhere in rocks.

Adula stylina Cpr.

In rocks on ocean beaches; not rare.

Septifer bifurcatus Rve.

Larger and coarser than *Mytilus bifurcatus;* abundant.

Lithophagus plumula Hanley.

La Playa, with pholads; rare.

Lima dehiscens Conr.

Under stones, living near high-water mark, False Bay, April, 1882. Also Todos Santos Bay, but not found alive.

Pecten monotimeris Conr.

Not often collected.

Pecten æquisulcatus Cpr.

Abundant at seasons in San Diego Bay. Todos Santos Bay. Often collected for food.

Hinnites giganteus Gray.

This fine species we find abundant at La Playa, but elsewhere on the coast it appears rare, though not absent.

Anomia lampe Gray.

Todos Santos Bay.

Placunanomia macroschisma Desh.

Usually inhabiting deep water, attached to stones or bones of whales. Rarely collected.

Ostrea lurida Cpr.

Abundant and very variable in size and form.

BRACHIOPODA.

Platidia anomioides (Scacchi) Costa. var?

Terebratula anomioides Scacchi, Phil. Moll. Sicil., ii, p. 69, pl. xviii, fig. 9, 1844.

[Mediterranean; North Atlantic; Florida Strait; San Diego, Cal., and Todos Santos Bay, Orcutt.

The shells which I refer to the above species are in general like

those from the Mediterranean. The differences are such as might result from the habitat or place of attachment of the shells. All the Californian specimens have the larger valve flat, with faint ridges radiating from the umbo and becoming obsolete before reaching the margin. The hæmal (or dorsal) valve is convex, and the foramen is often anteriorly angulated, though sometimes round. In all the specimens the part of the foramen included in the hæmal valve is larger than that included in the neural valve. The apophyses are similar to those of Mediterranean specimens. I have from the Caribbean Sea a specimen similarly radiated, and for this form perhaps we may apply the varietal name *radiata*.

The special interest attaching to these little brachiopods arises from the fact that this is the first time they have been reported from the Pacific. The San Diego specimens were evidently from the beach; though perfect, they were a little bleached. The single specimen from Todos Santos Bay, though dry, contained the remains of the soft parts. D.]

NOTES ON A COLLECTION OF FISHES FROM FLORIDA, WITH DESCRIPTIONS OF NEW OR LITTLE KNOWN SPECIES.

By O. P. HAY.

The fishes forming the subject of the present paper were contained in a small collection made in Florida and sent to me by Messrs. H. T. Mann and D. M. Davison. A part of the collection was made in Western Florida, at Chaffin, on the Yellow Water River, and at Westville, near the Choctawhatchee River; but the greater part in the eastern portion of the State, principally at Saint Augustine. The work was done during the month of April of the present year and under very unfavorable circumstances. However, in this paper I describe *Gobionellus smaragdus* (C. & V.) Grd., obtained for the first time on our coast; *Zygonectes nottii* Ag., not before identified since it was originally described; *Z. auroguttatus*, and *Etheostoma* (*Ulocentra*) *davisoni*, which are believed to be new species. Notes on *Mugil albula* L. and *Labidesthes sicculus* Cope are incorporated.

1. Gobionellus smaragdus (C. & V.) Grd.

Among the fishes collected at Saint Augustine there occurs a species of Goby that must be placed under Girard's genus *Gobionellus*. The single specimen which was captured having been submitted to Prof. D. S. Jordan's inspection, has been identified by him as the *Gobius smaragdus* of Cuvier and Valenciennes. Dr. Gunther in his "Catalogue of the Fishes of the British Museum" gives the name of this species without any description except that it is related to *Gobius lanceolatus*. As it

has not hitherto been announced as occurring on our coast, I proceed to give a detailed description of it.

Form elongated, head blunt, and caudal fin long and lanceolate.

Head rather large in all its dimensions; its length in the body to caudal fin 4 times; broadest at the corners of the mouth. This dimension equal to the depth of the head and contained in length of head $1\frac{1}{2}$ times. Mouth large and somewhat oblique, the maxillary extending back to a vertical from the posterior border of the pupil. No barbels. Skin of upper and lower lips ample. Premaxillary freely protractile. Snout broadly rounded and rapidly decurved. Teeth of the outer series of the upper jaw enlarged and recurved. The teeth of the outer series of the lower jaw are of moderate size and movable; while those of the inner row, about 8 on each side, are enlarged and firmly fixed. Lower jaw broad and thin. Nasal openings of each pair wide apart. Eyes small, in length of head 5, high up; interorbital space equal to the diameter of the eye. Snout a little greater than the diameter of the eye. Cheeks flat and nearly perpendicular. Head wholly devoid of scales. No tentacle above the orbit, and no crest on the back of the head or neck. Body somewhat compressed, the depth in length 6 times. Scales strongly ctenoid, small in front, becoming larger posteriorly; very irregularly arranged; about 52 rows from operculum to base of caudal fin, and about 16 longitudinal rows between the origins of the anal and soft dorsal. Rays of fins as follows: D. VI–11; A. 12; dorsals well separated. Spines of first dorsal ending in filaments, that of the third spine being longest. Pectorals rather large, no rays silky. Ventrals united to form a sucking disk that is free from the belly. Caudal nearly half as long as the body and lanceolate.

Color of body yellowish olive. Along the sides are five or six dusky blotches, the one at the middle of the length the largest and most distinct. One of these forms a caudal spot. Another spot lies just above and behind the opercle. Above the rows of spots and between them are numerous splotches of dusky. Along the sides are several circular spots about the size of the pupil, apparently, in life of a bright yellow color, and each encircled with a dusky ring. Belly apparently of a livid blue. Head yellowish and dusky, mottled above and on the sides. Snout, upper and lower lips, and streak back from symphysis of mandibles, livid blue. Cheeks each with about six or eight yellow ocellated spots. One or two similar spots on each operculum. Dorsal fins mottled and barred with dusky; the filaments of the spinous dorsal yellow. Caudal dusky; a few of the upper rays white, or in life possibly yellow; the lower edge of the caudal nearly black. Anal and the united ventrals blue-black. Pectorals barred with dusky.

Total length of specimen $4\frac{5}{8}$ inches; length, exclusive of caudal, $3\frac{1}{8}$ inches.

To the writer it appears that, until the osteology of the various forms

of *Gobiidæ* have been studied, *Gobionellus* must be separated from *Gobius*, if at all, on the characters furnished by the teeth. The body may be short or long, as illustrated by the species *G. oceanicus* and *G. stigmaticus;* the head naked or scaly above, the scales of the lateral line many or few. The outer lower teeth of *G. smaragdus* can hardly be regarded as "setaceous."

2. Etheostoma davisoni, n. sp. Subgenus *Ulocentra*, Jordan.

Founded on a single specimen seined in the Yellow River, near Chaffin, in Santa Rosa County, Florida. Length to base of caudal fin, $1\frac{3}{8}$ inches. Named in honor of Mr. D. M. Davison, one of its collectors. Body elongate, slender, considerably compressed. Head long, narrow, rather pointed, the snout not being rapidly decurved as in other species of *Ulocentra* and in *Vaillantia camura.* Depth in length to base of caudal $6\frac{1}{2}$. Head in length $4\frac{1}{5}$. Eye in the head 3. Snout about three-fourths the diameter of the eye. Interorbital space narrow. Horizontal diameter of the head through the pupils equal to two-thirds the perpendicular diameter at the same point. Mouth large, horizontal, terminal, the maxillary extending back to a perpendicular from the pupil; cleft of the mouth one-fourth the length of the head. Jaws about equal; the premaxillary freely protractile; the maxillary not adnate to the preorbital. Cheeks and opercles densely scaly; the opercular spine well developed. Gill-membranes narrowly connected. Vomerine teeth apparently present.

Body covered with scales except on the chest. Scale formula 5–50–7. Lateral line incomplete, pores being developed on about 30 scales. Dorsals IX–10, well separated. A. II–6. Base of the spinous dorsal in the length of body $4\frac{1}{2}$; its height in same distance 7 times. Base of second dorsal in the body 7 times; its height about the same. Its origin about midway between the snout and the tips of the caudal rays. Anal spines well developed, the first rather stronger. Base of anal in length of body $8\frac{1}{2}$, its height $7\frac{1}{2}$ times. Pectorals extending back to the eighth dorsal spine, the ventrals falling short of the tips of the pectorals. Body not contracted at the vent as it is in *Vaillantia camura.* Caudal peduncle compressed, tapering gradually to the caudal fin, its length (from anal) in body, $3\frac{3}{4}$ times. Distance from the vent to the base of the caudal fin equal to the distance from the vent to the posterior border of the orbit. In *V. camura* the distance from the vent to caudal reaches only from the vent to the base of the opercular spine.

General color olivaceous. Many of the scales, each with a dark blotch, which blotches unite to form zigzag and W-shaped markings, especially above the lateral line. Along the sides there are about 10 larger nearly square spots; of which the largest are on the caudal peduncle. Belly and chest under a lens are seen to be thickly sprinkled with black dots. A black streak downward from the eye and another forward to the snout. Fins dusky. Both dorsals with a row of dusky spots lying between the rays. Caudal barred.

This species seems to resemble *U. stigmæa* Jor., as the latter is described in the Synopsis of Fishes of North America. It differs, however, from *U. stigmæa* in the fin-formula, in having the premaxillaries freely protractile, and in having the cleft of the mouth extending behind the anterior border of the eye. Professor Jordan's species is also described as having the head obliquely truncate in profile.

3. **Labidesthes sicculus** Cope.

A single specimen of this fish was obtained at Westville, in Holmes County. Its color is a dark olive-green instead of the pale-olive green that characterizes our northern specimens. This species was originally described by Professor Cope from specimens found in Michigan. In 1881, in Bulletin U. S. Fish Commission, Vol. II, 64, I noted the occurrence of this fish at several points in the State of Mississippi. I have now succeeded in tracing its distribution to the Gulf.

4. **Mugil albula** L.

Several specimens of these were obtained at Saint Augustine. I find nothing noteworthy about them except that their caudal fins are squamated nearly to the tips. Other fins scaleless or nearly so.

5. **Heterandria ommata** Jordan.

Zygonectes mannii, n. sp., Hay, MS.*

This species is described from two specimens, the largest of which is but seven-eighths of an inch in length from the snout to the tip of the caudal fin. The smaller specimen, on being subjected to autopsy, proved to be a female with well-developed ova. The species may, therefore, contend with *Girardinus formosus* for the honor of being the smallest known vertebrate.

The fish is fusiform in outline, slender, and somewhat compressed. The depth is contained in the length to the base of the caudal $5\frac{1}{2}$ times. The head in the same distance, 4 times. The premaxillary is extremely protractile. The mouth is very small, the cleft almost perpendicular, descending scarcely to the level of the center of the pupil. The ventral surface of the lower jaw looks almost directly forward, so that the anterior end of the fish is truncated. The teeth are pointed; but whether in one row or more I have not been able to determine with certainty. The eye is large and circular, twice the length of the snout, and contained in the head $2\frac{1}{2}$ times. The upper surface of the head is flat, and the interorbital space about equal to the diameter of the eye. The gill-membranes are narrowly connected and free from the isthmus.

Scales covering the body rather large, in about 30 transverse and 9 longitudinal rows. Rays of fins as follows: D. 7, A. 10. The anal slightly in advance of the dorsal. The beginning of the dorsal is midway between the hinder border of the opercle and the base of the cau-

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* A comparison of Prof. Hay's proposed new species with the types of *Heterandria ommata* shows that the two are identical. The statement in the original description relative to the position of the dorsal is incorrect.—T. H. BEAN.

dal. The anal has its first ray situated midway between the posterior border of the orbit and the base of the caudal. Pectorals and ventrals small. The former have a length about equal to one and a half times the diameter of the eye. The tips of the ventrals reach the first anal ray. The caudal fin is ovate and equal to the length of the head. The caudal peduncle is broad and compressed. As in other members of the family there is no lateral line.

The ground color is pale straw. The upper surface, for a distance of about three scales length on each side of the middle line, is dusky, rendered so by numerous microscopic punctulations. There is also a narrow dark vertebral line anterior to the dorsal fin. On the side, just in front of the origin of the anal fin and nearer the ventral than the dorsal line, there is a jet black spot about as large as the pupil; and just in front of the base of the caudal there is a similar, but somewhat larger, spot. Beginning at the anterior spot there is a dark band, formed of minute punctulations, that runs backward nearly to the caudal spot. Just before reaching the spot the band widens and at length divides, sending one branch upward and another downward. The latter passes below the spot, unites with a dark streak along the lower edge of the caudal peduncle, and is thus carried upward at the base of the caudal until it unites with the dusky band on the dorsal surface of the caudal peduncle. The caudal spot is therefore surrounded by a ring of the ground color, which ring at its upper edge joins with a band of the same color lying between the dark lateral and the dusky dorsal bands. A dark streak starts at the bases of the ventrals and passes backward on each side of the anal, where it is most conspicuous, to the base of the caudal. Top of the head dark. A narrow dark streak runs forward from the eye and spreads over the whole lower jaw. There is no dark streak below the eye. Beginning at the hinder border of the orbit there is an indistinct dusky band, produced by scattered punctulations, that runs backward nearly to the lateral black spot. Just before reaching the spot it widens and divides into two short branches, an upper and a lower. Thus the latter spot is less completely ocellated than is the caudal.

Male unknown. That the species does not belong to the genus *Girardinus* is indicated by the fact that the intestine is not longer than the body. It is possible that it is a *Gambusia;* but I do not think this probable.

6. Zygonectes auroguttatus,* n. sp.

Depth in length $4\frac{1}{3}$; head $3\frac{1}{2}$; Fins: D. 8 or 9; A. 10; scales 32–12. Body rather elongate and compressed. Depth contained in the length to the caudal from $4\frac{1}{4}$ to $4\frac{1}{3}$ times. Caudal peduncle short and deep; its length in that of the body 4 to $4\frac{1}{2}$ times; its depth nearly two-thirds

*This species is almost certainly identical with *Z. rubrifrons*, Jor., which, moreover, is apparently the same as *Z. henshalli*, Jor.—T. H. Bean.

its length. Head broad and flat above. Interorbital space in the head $2\frac{1}{3}$ times. Eye in head $3\frac{1}{2}$ to 4, overhung slightly by the supra-orbitals. Snout obtuse, equal to the eye. Cheeks nearly perpendicular, so that the head is not narrowed below as in some species of *Zygonectes*. Mouth small, rather oblique, the lower jaw heavy and projecting beyond the upper. Teeth in a broad band in each jaw, the outer enlarged. First ray of dorsal placed directly over, or slightly behind, the first of anal. Distance from first ray of dorsal to insertion of the caudal falling behind the edge of the operculum. Both dorsal and anal larger in male than female. The posterior rays of anal of male the longest. Pectorals of males reaching the base of the ventrals. Ventral tips reaching the vent. Both shorter in the females. Caudal broad and fan-shaped. Color dark olive, paler below from lower jaw to caudal. Males with about 12 or 14 distinct transverse stripes, which are narrower than the interspaces. These occupy the whole side from the base of the caudal to the insertion of the pectorals, but are most distinct posteriorly. In fresh specimens each scale has in its center an orange or bronzy spot. Along the sides these form distinct longitudinal rows. In the females the transverse bands are indistinct on the anterior half of the body, but distinct posteriorly. All the scales have black edges which give the fish a cross-hatched appearance. Sides of the female, also, with numerous spots of bronze and a rather conspicuous row of dark spots along the place of the lateral line. The vertical fins all with dusky tips; otherwise plain.

Eight specimens obtained at Westville. Length of longest male $1\frac{1}{2}$ inches; of longest female nearly 2 inches.

7. **Zygonectes nottii**, Agassiz.

In the American Journal of Science and Arts for 1854, on page 353, Prof. L. Agassiz described in a brief manner several species of *Zygonectes*, among which is *Z. nottii*. I quote so much of his language as is applicable to this species.

"The species of the genus *Zygonectes* may be arranged in two groups: 1, those in which there are several more or less distinctly dotted lines along the sides of the body and in which a broad black band extends across the eye and cheek. To this group belong: *Z. nottii*, Agass. The darker longitudinal lines alternate with fainter interrupted ones. Males with distinct transverse bands. Dark olive above, fading upon the sides, silvery below. Operculum, throat, and space in advance of the eye light orange color. Mobile, Ala. Collected there with Dr. Nott. Mississippi: Colonel Deas.—*Z. lineolatus* Agass. Longitudinal lines broader and undulated or serrated, the transverse bands of the male very distinct and broader than the longitudinal ones; olive colored, darker along the back and fading upon the sides, lower parts silvery. Discovered by Dr. W. I. Burnett at Augusta, Ga."

In referring to these species of Professor Agassiz, Messrs. Jordan and

Gilbert, in their Synopsis of the Fishes of North America, say: "Professsor Agassiz (Amer. Jour. Sci. Arts, 1854, 353) mentions three more species of this genus, which have not since been recognized, besides two (*Z. lateralis* and *Z. zonatus*) which are evidently identical with *Z. notatus*, and another, *Z. lineolatus*, which Professor Putnam informs us is identical with *Z. nottii*."

Among the fishes collected at Westville, Holmes County, Florida, there are two specimens of a *Zygonectes* that agree so well with Professor Agassiz's description of *Z. nottii* that I have no hesitation in assigning them to that species. I proceed to give a detailed description of the more characteristic specimen in my possession.

Length of largest specimen, apparently a male, $1\frac{1}{5}$ inches to base of caudal. Head in length $3\frac{2}{3}$; depth in $4\frac{1}{2}$; dorsal 7 or 8; anal 9 or 10; scales 36–10. Form of body much like *Z. dispar* Ag., compressed behind; head broad and somewhat concave above, narrow below; interorbital space fully one-half the length of the head, $1\frac{1}{3}$ the diameter of the eye; snout obtuse, shorter than the eye; outer row of teeth, above and below, enlarged and recurved; eye large, its diameter in the head $2\frac{2}{3}$ times.

Pectoral fin two-thirds the length of the head; ventrals slightly shorter, attaining the vent; dorsal and anal low, little higher than one-half the length of the head. First ray of dorsal situated slightly behind the first anal ray, and over about the 17th scale in the longitudinal series. The distance from the snout to the first dorsal ray passing beyond the tips of the caudal rays. The distance from the first dorsal ray to the base of the caudal reaching forward to the insertion of the pectoral.

Color.—Belly and ground color on lower half of body silvery. Sides with six narrow longitudinal black stripes running from the head to the tail. These stripes a little narrower than the interspaces and perfectly distinct even on the caudal peduncle, the upper stripe rather faint and succeeded higher up by one or two other obsolete stripes. The interspaces of the stripes are occupied, especially above, each by a row of black dots forming the fainter interrupted stripes of Professor Agassiz's description. On the back these rows of dots are rather more distinct than the continuous stripes. There is a median dorsal stripe; about 10 transverse bars of the width of the longitudinal stripe, but fainter, and placed about two scales width apart, occupy the posterior half of the body. Lower surface of caudal peduncle dotted with black, a black streak behind the edge of the opercle. Upper surface of the head dusky and also the snout and tip of lower jaw. A broad black mask covering the eyes and extending downward over the cheeks; upper half of the operculum, the space in front of the eye and most of the lower jaw, orange red; lower half of the operculum and anterior half of breast yellowish orange.

As compared with *Z. craticula* Goode and Bean (Proc. U. S. Nat. Mus., 1882, 433), the species now under consideration appears to differ in the following respects: The interorbital space is wider, the snout shorter, the caudal peduncle shorter, thus bringing the insertion of the dorsal relatively further back; there are rows of dots in the spaces between the longitudinal stripes, and the fish has orange, instead of "brilliant white," cheeks. It is possible, however, that *Z. craticula* will prove to be a synonym of *Z. nottii*.

BUTLER UNIVERSITY, *Irvington, Ind., July* 1, 1885.

DESCRIPTION OF AN APPARENTLY NEW SPECIES OF DROMOCOCCYX FROM BRITISH GUIANA.

By ROBERT RIDGWAY.

Dromococcyx gracilis, sp. nov.

SP. CHAR.—Smaller than *D. phasianellus* (Spix), with much slenderer bill, narrower rectrices, and different coloration. *Adult* (No. 81,853, U. S. Nat. Mus., Demerara, British Guiana; O. Lugger, coll.). Pileum dull ferruginous, the concealed central and basal portion of the feathers dusky, the lengthened occipital feathers brighter rusty at ends; auriculars dull ferruginous; rest of head, including superciliary stripe, and also the chin, throat, jugulum, and cheeks, deep ochraceous (paler on the chin and throat), wholly free from markings. Upper parts blackish, the feathers broadly margined with ash-gray, the terminal margin of the wing-coverts, broadly, dull buffy white; upper tail-coverts each with a terminal small rhomboidal spot of white. Rectrices dull brownish slate on upper surface, each broadly tipped (for about .30 of an inch) with dull white; under surface brownish gray, with white shafts, the white tip on each feather preceded by a subterminal bar of dull black, about .30 of an inch (more or less) in width. Lower parts (from jugulum back, including lining of wing) immaculate dull white. Wing, 5.50; tail, 6.80 (the intermediæ projecting 1.75 beyond tips of the longest upper coverts); culmen, .95; bill from frontal apices, .70; greatest depth, .20; tarsus, 1.10.

This species may possibly be the same as von Pelzeln's *D. pavoninus* (Orn. Bras., p. 270), from Southern Brazil; but the description of the latter is so meager as to render the name practically a *nomen nudum*.

CATALOGUE OF A COLLECTION OF BIRDS MADE ON THE ISLAND OF COZUMEL, YUCATAN, BY THE NATURALISTS OF THE U. S. FISH COMMISSION STEAMER ALBATROSS, CAPT. Z. L. TANNER, COMMANDER.

By ROBERT RIDGWAY.

In a pamphlet* of four pages, entitled "Description of some New Species of Birds from Cozumel Island, Yucatan," published at Washington, February 26, 1885, the writer gave brief diagnoses of thirteen new species, and promised "a full report upon the collection" to "be published in the Proceedings of the U. S. National Museum." On account of pressure of other duties, it has not been found practicable to make the report as complete as might be desired, or to present it sooner; but it is believed that on many accounts it will be better to publish it in its present form, rather than secure greater elaboration at the expense of additional delay.

The collection upon which this paper is based comprises 232 skins and 177 specimens in alcohol, the total number of specimens being 429 and of species 57. It was made during the period dating from January 22–29, 1885, by Mr. J. E. Benedict, resident naturalist of the Albatross, assisted by Mr. Thomas Lee, Dr. Tarleton H. Bean, and Capt. J. W. Collins.

Before proceeding further with this paper I would refer to one by Mr. Osbert Salvin† in the Ibis, for April, 1885 (pp. 185–195, pl. v), in which is given a brief description of the island, and an annotated list of 27

* This paper will also be found in Vol. III (1884–'85) of the Proceedings of the Biological Society of Washington. The original edition comprised 250 copies, many of which were distributed on the date of printing, and others on March 2. The gratuitous distribution of this pamphlet by the author does not deprive it of its public character, it having thus acquired a circulation far more extensive than if offered for sale; and this is especially true since it was sent immediately or very soon after printing to all who were supposed to be specially interested in the subject to which it pertained. Both the Proceedings of the Biological Society of Washington and those of the U. S. National Museum are published under the immediate auspices of the Smithsonian Institution, and the edition of separately dated signatures or extras is specially designed to secure "immediate or extensive circulation," as recommended by the committee of the British Association. The number of pages comprised in a publication is a matter of even less importance, it seems to us, than the date of printing (in contradistinction to date of *publication*); and it will hardly be questioned that if the paper under consideration had comprised a hundred or more pages its claim to recognition would not have been challenged. In short, having all the requirements of a separate publication, including an edition equal to that of many important ornithological works, and having been promptly and extensively distributed, there appears to be no reason why the paper which has called forth these remarks may not be legitimately recognized and quoted. (*Cf. The Ibis*, July, 1885, pp. 237–238.)

† On a Collection of Birds from the Island of Cozumel, by Osbert Salvin, M. A., F. R. S., &c.>*The Ibis*, ser. v, vol. III, April, 1885, pp. 185–195, pl. v.

Vol. VIII, No. 36. Washington, D. C. Oct. 17, 1885.

species, based on a small collection made by Mr. E. C. J. Devis. In this paper are mentioned 6 species which were not obtained by the naturalists of the Albatross, viz, *Cyanospiza* (=*Passerina*) *ciris*, *Dolichonyx oryzivorus*, *Hadrostomus* (undetermined species), *Picus scalaris*, *Columba leucocephala*, and *Engyptila jamaicensis*. Two supposed new species were also described and one of them figured, these being *Harporhynchus melanostoma* and *Spindalis exsul* (pl. v), equal, respectively, to our *H. guttatus* and *S. benedicti*. In order to render the list of Cozumel birds more complete, it has been thought best to incorporate the additional species given by Mr. Salvin, but at the same time distinguishing them typographically from the others.

Family SYLVIIDÆ.

Subfamily POLIOPTILINÆ.

1. **Polioptila cœrulea** (Linn.). Eight specimens.

Family MIMIDÆ.

2. **Harporhynchus guttatus**, Ridgw.

Harporhynchus guttatus, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 1.

Harporhynchus melanostoma, SALV. Ibis, April, 1885, 187.

SP. CHAR.—Similar to *H. longirostris* (Lafr.), but smaller, darker, the bill wholly deep black, and all the markings more sharply defined.

Adult ♂ (No. 102,454, U. S. Nat. Mus., Cozumel, January 23, 1885): Above deep ferruginous-umber, darker or inclining to burnt umber on the tail; middle and greater wing-coverts sharply tipped with buffy white (nearly pure white on middle coverts), the white tips preceded by a broader subterminal bar of blackish. Lower parts buffy white, the entire chin, throat, abdomen, anal region, and crissum immaculate, the latter, also the flanks, more decidedly buff; jugulum, breast, sides, and flanks marked with guttate streaks or spots of dull black, similar but smaller markings bordering the throat on each side almost to the chin. Side of head uniform brown, paler than pileum, and bordered below by a dull-white malar stripe. Bill uniform deep black; legs and feet dusky horn-color. Wing, 3.55; tail, 4.45, graduated for 1.00 inch; culmen, 1.25; bill from nostril, .85; tarsus, 1 25; middle toe, .80.

The two other specimens in the collection are undetermined as to sex. No. 102,456 agrees essentially with the type as described above, but differs in its measurements, and is perhaps a female. The other (No. 102,455) is almost pure white beneath, there being a barely perceptible

buffy tinge on the jugulum. The measurements of these two examples are as follows:

Number.	Date.	Wing.	Tail.	Culmen.	Bill from nostril.	Tarsus.	Middle toe.	Graduation of tail.
No. 102,455	Jan. 28	3.40	4.10	1.25	.85	1.25	.85	.90
No. 102,456	Jan. 29	3.40	4.10	1.20	.80	1.15	.85	.90

The occurrence of a species of this genus on Cozumel is remarkable, since no *Harporhynchus* has yet been detected in Yucatan, *H. longirostris*, its nearest ally, having its southern limit, so far as known, in the State of Vera Cruz (Jalapa, Cordova, and Mirador).*

3. Mimus gilvus gracilis (Caban.).

Seven examples, agreeing with Yucatan (Merida) specimens, except that the gray of the upper parts is decidedly purer or less brownish, as is also the white of the lower parts. They all agree with the Yucatan specimens in having the wings decidedly black, in strong contrast with the rather light ash-gray of the upper parts, and relieved by very sharply defined pure white tips to the wing-coverts (both rows), being thus very readily distinguished from *M. gilvus* and allied forms. (See these Proceedings, Vol. 5, pp. 10–12.) Some of the Cozumel specimens have the superciliary stripe very distinct, being in this respect similar to *M. gilvus*, from which, however, they may be distinguished not only by the very different coloration of the wings, but also by the greater extent of white on the tail feathers, that on the lateral pair of rectrices approaching very closely to the end of the under tail-coverts.

4. Galeoscoptes carolinensis (Linn.).

Three specimens. Said to be common, associated with *Melanoptila glabrirostris*, and supposed by the natives to be the female of that species!

5. Melanoptila glabrirostris, Scl.

Twelve specimens (seven in alcohol), apparently the same as the true *M. glabrirostris;* but of the latter we have only one imperfect skin for comparison, the bill and feet being broken and the plumage perhaps not of the brightest. The five Cozumel skins are a rich, silky violet-black, except the wings and tail, which are greenish black, and the abdomen, which is a dead black, or almost without gloss. The violet color of the back extends to the upper tail-coverts, which are only a little more blu-

* Mr. Salvin thus refers to this curious isolation of *H. guttatus*, and its close relationship to *H. longirostris:* "This *Harporhynchus* is allied to *H. longirostris* (*cf.* Salv. & Godm. Biol. Centr.-Am., Aves, i. p. 31), and at first sight might easily be mistaken for it. The mandible is black to the base, and the dimensions, especially the wing, are much less. Moreover, there is a wide gap in the ranges of the two birds, *H. longirostris*, so far as we know at present, not occurring in any locality nearer than the State of Vera Cruz." (Ibis, April, 1885, p. 187.)

ish. In the specimen of true *glabrirostris* (No. 30,652, Half Moon Bay, British Honduras, May 10, 1862) the plumage is less glossy, especially on the rump and upper tail-coverts, while the bill and feet, as nearly as can be told from their mutilated condition, appear to be weaker. The differences are at most very slight, however, and unless perfectly constant would not suffice for the separation of the Cozumel bird even as a local race.

Very abundant, and said to be a very brilliant and melodious songster.

Family TROGLODYTIDÆ.

6. **Troglodytes beani**, Ridgw.

Troglodytes beani, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 1.

SP. CHAR.—Largest species of the genus (wing, 2.10–2.20; culmen, .75 or more). Above grayish brown, becoming more of a burnt-umber tint posteriorly, the tail and wings rather distinctly barred with dusky, the other upper parts either perfectly plain or with barely discernible narrow bars of a darker tint on lower back, etc. Lower parts white, the jugulum and sides tinged with brown, the flanks decidedly brownish; lower tail-coverts light rusty, tipped with white and barred with dusky.

Adult ♂ (type, No. 102,473, U. S. Nat. Mus., Cozumel, January 28, 1885): Above plain brown, more grayish anteriorly, and more of a burnt-umber cast posteriorly, especially on the rump, where the feathers have concealed, subterminal, large guttate spots of white, the basal portion being slate-colored. Tail and wings duller umber than rump, narrowly and indistinctly barred with dusky. Lower parts white, purest on the malar region, chin, throat, and abdomen, the sides and flanks pale fulvous-brown, the lower tail-coverts light rusty, tipped with white and barred with blackish. Maxilla black, the tomium paler; mandible with terminal half dusky, the basal half light yellow; legs and feet horn color. Fifth and sixth quills longest; tail graduated for .30 of an inch. Wing, 2.20; tail, 1.90; culmen, .81; bill from nostril, .50; tarsus, .80; middle toe, .50.

Four of the five specimens have no indication of bars on the lower back, rump, or upper tail-coverts; the fifth, however (No. 102,474, ♂ ad.), has very indistinct and narrow darker bars on all these portions.

The only species which this one resembles in coloration is the *T. inquietus*, Baird, from Panama, which, however, is much smaller, and differs in other characters.

Family MNIOTILTIDÆ.

7. **Mniotilta varia** (Linn.). Three specimens.

8. **Compsothlypis americana** (Linn.). Seven specimens.

9. **Dendroica petechia rufivertex**, Ridgw.

Dendroica petechia rufivertex, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 1; Proc. U. S. Nat. Mus., VIII, 1885, 348 (detailed description and comparison with allied forms.)

10. **Dendroica virens** (Gmel.). Fifteen specimens.
11. **Dendroica cœrulescens** (Linn.). Adult male and female.
12. **Dendroica maculosa** (Gmel.). Two examples.
13. **Dendroica dominica albilora** Baird.

Seven specimens, all decidedly referable to this form, since, although three examples have more or less yellow above the lores, the measurements are those of *albilora*. Respecting the characters of this form, it may be remarked that while as a rule the superciliary stripe is entirely white, it is often yellow anteriorly in specimens which are otherwise typical. In true *dominica*, on the other hand, the superciliary stripe is apparently always yellow anteriorly, while the bill is much longer than in the western form.

The occurrence of this form to the exclusion of the true *dominica*, which alone winters in the West Indies, shows the importance of carefully discriminating between geographical races, however slightly they may be differentiated. The following species is a similar illustration of the case, although the facts of distribution are different, the typical form wintering in both the West Indies and on Cozumel (but not on the mainland), while *D. palmarum hypochrysea* apparently does not pass beyond the South Atlantic and Gulf States.

14. **Dendroica palmarum** (Gmel.). Seven specimens.
15. **Dendroica discolor** (Vieill.). Three specimens.

This is another species of Eastern North America which winters both in the West Indies and on Cozumel, but apparently not on the mainland of Middle America.

16. **Seiurus noveboracensis notabilis**, Ridgw. Two specimens.
17. **Seiurus aurocapillus** (Linn.). Two specimens.
18. **Geothlypis trichas occidentalis**, Brewst. Three specimens.

These are interesting as showing that it is the interior and western form which winters on Cozumel, and not the eastern. The latter winters in the South Atlantic States, the Bahamas, Cuba, and Jamaica.

19. **Sylvania mitrata** (Gmel.). Four adult males.
20. **Setophaga ruticilla** (Linn.). Seventeen specimens.

Family CŒREBIDÆ.

21. **Certhiola caboti**, Baird.

Twenty-four skins and twenty-two alcoholic specimens confirm the validity of this species. It is, as indicated by Professor Baird in the original description (*American Naturalist*, VII, 612, and *Hist. N. Am. B.*, I, p. 427), nearly related to *C. bahamensis;* but it has a still closer ally in the recently described *C. tricolor*, nobis, from the island of Old Providence, in the Caribbean Sea. (See these Proceedings, Vol. VII, p. 178.) With the latter it agrees in the greater extension of the yellow of the lower parts and the darker color of the back than in *C. bahamensis*.

Family VIREONIDÆ.

22. Vireo cinereus, Ridgw.

Vireosylvia cinerea, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 2.
Vireo magister, SALVIN, Ibis, April, 1885, 188 (nec BAIRD).

SP. CHAR.—Agreeing with *V. magister*, BAIRD, in absence of dusky submalar streak and dusky streak on side of crown, but plumage decidedly ashy, instead of brownish olive. (No spurious primary.)

Adult (type, No. 102, 656, U. S. Nat. Mus., Cozumel I., Yucatan, January 29, 1885). Above dull ash-gray, the pileum concolor with the dorsal region, but the lower part of rump and upper tail-coverts, with edges of rectrices and primaries, decidedly tinged with light olive-green. No trace of dusky streak on sides of pileum. A distinct and rather broad superciliary stripe of dull buffy white, becoming more ashy above the auriculars. A dusky grayish loral stripe, and a similar but less distinct postocular streak. Auriculars light brownish gray, gradually fading to dull whitish beneath the eye and on the throat. Lower parts dull white, very faintly tinged with buff, the sides and flanks rather abruptly olive-gray. Lining of wing and crissum yellowish white. No spurious primary. Bill dusky, the basal half of mandible whitish (pale bluish in life?); legs and feet plumbeous-dusky (plumbeous-blue in life?). Wing, 3.00; tail, 2.30; culmen, .90; bill from nostril, .45; tarsus, .80; middle toe, .45.

This species is closely related only to *V. magister*, Baird. In coloration, however, it bears a close general resemblance to *V. gilvus*, more so in fact than to any other member of the genus.

Two specimens in the collection.

23. Vireo flavifrons, Vieill. One specimen.

24. Vireo noveboracensis (Gmel.). Four specimens.

25. Vireo bairdi, Ridgw.

Vireo bairdi, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 2.

SP. CHAR.—Above tawny olive, the wings with two broad yellowish white bands. Lores and median lower parts pure white; lateral lower parts, from cheeks to flanks, deep tawny buff, in abrupt contrast with the white.

Adult ♂ (No. 102,635, U. S. Nat. Mus., Cozumel I., Yucatan, January 25, 1885). Above deep olive-brown, or tawny olivaceous, the pileum more grayish, although decidedly tawny anteriorly and laterally; remiges and rectrices edged with yellowish olive-green, the tertials with broader edgings of yellowish white; middle and greater wing-coverts edged with olive-greenish, and broadly tipped with yellowish white. Lores, orbital ring (interrupted on upper eyelid), malar region, chin, throat, and median lower parts pure white. Lateral lower parts, including sides of forehead, auriculars, sides of neck and breast, sides, and flanks, deep tawny buff or cinnamon-ochre, in abrupt contrast with

the white. Lining of wing pure white, the edge of wing and axillars tinged with sulphur-yellow; crissum white, faintly tinged with yellow. Maxilla light brown, with paler tomium; mandible whitish; legs and feet grayish brown (plumbeous in life ?). Wing, 2.50; tail, 2.15; culmen, .60; bill from nostril, .30; tarsus, .89; middle toe, .45.

This species is so very distinct as not to require comparison with any other at present known, being wholly unique in and immediately recognizable by, the pure white median lower parts, strongly and abruptly contrasted with the bright tawny or ochreous lateral portions. It belongs decidedly to typical *Vireo*, and not to the section *Vireonella*, as defined by Professor Baird in his "Review of American Birds" (p. 326).

The species is dedicated to Prof. Spencer F. Baird, among whose numerous valuable contributions to ornithological literature is an elaborate monograph, by far the best and most complete extant, of the North and Central American *Vireonidæ*, in the work above mentioned (pages 322–400).

Six skins and thirteen alcoholic specimens are represented in the collection.

+**26. Cyclorhis insularis,** Ridgw.

Cyclorhis insularis, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 2.

SP. CHAR.—Similar to *C. flaviventris* in color of pileum, but agreeing with *C. ochrocephala* in coloration of the lower parts.

Adult ♀ (type, No. 102,659, Cozumel I., Yucatan, January 28, 1885): Pileum dull brownish gray, bordered anteriorly and laterally by a well-defined frontal band and superciliary stripe of bright rufous; malar region, auriculars, and nape, cinereous, the chin similar but paler. Remaining upper parts uniform olive-green, decidedly duller, or less green, than in *C. flaviventris* or *C. ochrocephala*. Throat, jugulum, side of breast, sides, and flanks, light olive-yellow; breast, abdomen, anal region, and crissum, white; lining of wing pale sulphur-yellow, much paler than in the allied species. Maxilla and terminal portion of mandible pale brown; basal half of mandible dusky (plumbeous or bluish in life ?); legs and feet light brown (fleshy in life ?). Wing, 3.30; tail, 2.60; culmen, .85; bill from nostril, .50; depth, .38; tarsus, 1.00; middle toe, .55.

Another specimen (No. 102,658, January 25), also a female, but evidently a younger bird, is decidedly duller in color, the pileum being more brownish, the rufous frontal band and superciliary stripe paler and less sharply defined, and the white of the abdominal region much more restricted, being apparently confined to the central and lower portion of the abdomen itself. This last feature, however, is to a great extent owing to the "make" of the skin, which is considerably contracted, but perhaps depends more on immaturity of the specimen. Wing, 3.00; tail, 2.30.

It is a singular fact that the only other species of the genus, besides *C. flaviventris*, Lafr., which this resembles, is the far separated *C. ochro-*

cephala, Tschudi, of southeastern Brazil, with which *C. insularis* agrees very closely in the coloration of the under parts. Indeed, it is at first difficult to determine whether *C. ochrocephala* or *C. flaviventris* is its nearest ally; but geographical considerations, together with a more exact resemblance to *C. flaviventris* in the coloration of the upper parts, leads us to regard the latter as most closely related.

Family TANAGRIDÆ.

+27. **Spindalis benedicti** Ridgw.

Spindalis benedicti, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 2.
Spindalis exsul, SALVIN, Ibis, April, 1885, 189, pl. v.

SP. CHAR.—*Adult* ♂ (type, No. 102,675, U. S. Nat. Mus., Cozumel I., Yucatan, January 29, 1885): Entire pileum, lores, suborbital region, auriculars, and broad submalar stripe, deep black; broad superciliary stripe and still broader malar stripe pure white, the latter wider posteriorly, and extending backward beyond the auriculars; chin white, stripe down middle of throat rich yellow. Nape and jugulum dark chestnut-brown. Back and scapulars dark olive-brown; upper part of rump yellowish olive, lower part, with upper tail-coverts, rich dark chestnut. Lesser wing-coverts rich chestnut, the anterior and innermost feathers black; rest of wings, with tail, deep black, the greater coverts and tertials broadly edged with pure white; a white patch at base of primaries, concealed by the coverts, however, on the two outer quills; primaries and secondaries narrowly edged with white, on the latter, however, extending only about two-thirds of the way to the tips of the greater coverts. Two outer rectrices with the terminal half mainly white; intermediæ with inner webs broadly edged with white. Breast and upper part of abdomen rich yellow; lining of wing, sides of abdomen, anal region, and crissum, white; sides and flanks light grayish. Bill blackish, the mandible plumbeous basally; feet dusky (plumbeous or bluish in life?). Wing, 3.40; tail, 2.90; culmen, .60; bill from nostril, .35; tarsus, .85; middle toe, .62.

Adult ♀ (No. 102,673, U. S. Nat. Mus., Cozumel I., Yucatan, January 28, 1885): Above uniform grayish olive; wings externally similar, but darker, the greater coverts and tertials showing broad but not sharply defined paler edges; primaries dusky, narrowly edged with grayish white, and showing a small white speculum at base of fourth and fifth quills; primary-coverts and alulæ plain dusky. Tail without white spots. Auriculars streaked with dusky and pale grayish olive; chin and broad malar stripe (poorly defined) pale grayish, tinged with olive; rest of lower parts pale grayish olive, changing to yellowish white on the belly, and soiled whitish on crissum and lining of wing. Wing, 3.20; tail, 2.70

Sixteen skins (eleven ♂, five ♀) and ten alcoholic specimens are included in the collection.

This fine species, perhaps the handsomest of the genus, agrees best in coloration with *S. zena* (Linn.), in the restriction of the yellow on the lower parts, and in the chestnut nape and upper tail-coverts. *S. zena*, however, is much smaller (wing 3.15 and tail 2.70 in the ♂), with the bill altogether more slender, has the back, scapulars, and lesser wing-coverts intense black, and much less of chestnut on the jugulum, which is widely separated from the yellow throat-stripe. In size it comes nearest the Jamaican species (*S. nigricephala*, James.), but the coloration is widely distinct.

28. Piranga roseigularis Cabot.

Three adult males, apparently identical with Yucatan specimens, although they have not been directly compared.

Family FRINGILLIDÆ.

29. Coturniculus savannarum passerinus (Wils.).

Two specimens, belonging decidedly to the eastern form, and not the western *perpallidus*.

30. Passerina cyanea (Linn.).

One example, an immature male.

[31. *Passerina ciris* (Linn.). Devis collection.]

32. Euetheia olivacea intermedia Ridgw.

Euetheia olivacea intermedia, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 2.

SUBSP. CHAR.—Intermediate between and connecting *E. olivacea* (Gmel.) and *E. olivacea pusilla* (Sw.), having the grayer cheeks of the former and greater extension of black on the breast of the latter. Type, No. 102,710, ♂ ad., Cozumel, January 28, 1885.

This interesting series, consisting of nineteen specimens (six skins, the remainder alcoholic), completely connects the West Indian *E. olivacea* with the continental *E. pusilla*. It being impossible to refer them to either, however, without doing injustice to the claims of the other, and their habitat being moreover isolated, we have felt obliged to name the Cozumel bird as a local race, as the best way out of the difficulty.

33. Cardinalis cardinalis saturatus Ridgw.

Cardinalis saturatus, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 4.

SUBSP. CHAR.—Similar to *C. cardinalis coccineus*, but coloration still more intense, and the bill shorter and relatively much thicker.

Adult ♂ (type, No. 102,720, Cozumel, January 24): Capistrum, including whole upper part of throat, black, this meeting very narrowly across the forehead. Rest of head and neck, with entire lower parts, deep vermilion-red, purer and more intense on the lower parts, somewhat obscured by dark brownish red tips to the feathers of crest, etc. Upper parts, including nape, uniform dark claret-red, without distinct gray-

ish tips to dorsal feathers. Bill deep coral-red; feet, horn-color. Wing, 3.55; tail, 4.00; culmen, .80; bill from nostril, .52; depth at base, .67; tarsus, 1.00; middle toe, 65.

Another adult ♂ (No. 102,718) measures as follows: Wing, 3.55; tail, 4.00; culmen, .82; bill from nostril, .52; depth at base, .70; tarsus, 1.00; middle toe, .70.

Adult ♀ (No. 102,719, Cozumel, January 23, 1885): Capistrum blackish slate; rest of head raw-umber brown, becoming paler and more ochreous on sides of forehead and sides of neck, the latter, also the jugulum and lower parts generally, deep dull ochraceous, darker and more olivaceous along the sides; abdomen paler or buffy ochraceous, the anal region buffy whitish; lining of wing pure light vermilion. Longer crest-feathers dark brownish red, with broccoli-brown tips. Nape, back, scapulars, rump, and upper tail-coverts uniform broccoli-brown; outer surface of wings dark dull red, the coverts and tertials edged with broccoli-brown. Tail dull dark red, the feathers edged with grayish brown; bill deep coral-red; feet horn-color. Wing, 3.45; tail, 4.05; culmen, .85; bill from nostril, .53; depth at base, .70; tarsus, 1.05; middle toe .72.

Three other adult females measure as follows: Wing, 3.35–3.40; tail, 3.65–3.95; culmen, .75–.80; bill from nostril, .50–.51; depth at base, .65–.68; tarsus, 1.00–1.03; middle toe, .65–.75.

This race is closely related to *C. cardinalis coccineus*, Ridgw., from which it is separated chiefly on account of the more somber coloration of the female, that of Yucatan specimens, provisionally referred to *coccineus*, being much more tawny, with still blacker capistrum, and also with much smaller bills. The males of *saturatus* differ from those from the mainland in the darker and more purplish cast of the dorsal plumage, the bill being also, as in the females, more robust.

It is doubtful whether the Yucatan birds of this species should be referred to the true *coccineus*, which was based upon specimens from the State of Vera Cruz. The writer has unfortunately been able to compare only males from the two regions. These agree minutely in coloration, but the Yucatan specimens are much smaller (smaller even than the Cozumel birds), and have relatively smaller bills. More material is necessary, however, to decide this question.

The authors of *Biologia Centrali-Americana* (*Aves*, I. p. 340) decline to accept the validity of *C. cardinalis coccineus*. They express their inability to "distinguish between specimens from Jalapa and others from Washington," and add that "as Sumichrast speaks of *C. virginianus* as a winter visitor to the State of Vera Cruz, the probability is that the birds of Eastern Mexico and Eastern States are of one species." The latter we do not deny, the name *coccineus* having been originally bestowed as a trinomial, and is retained as such, for the designation of a geographical race, whose claims, however, to recognition as a very strongly characterized form are clearly demonstrated by the specimens

before us, and which, without exception, differ uniformly and decidedly in the two regions.

Laying aside the males, which though themselves readily distinguishable are much less obviously different than the females, we find, upon comparison of two adult females from Yucatan (Merida) with *thirty* from the Eastern United States, that while the former have a very rich tawny ochreous general coloration and *black* capistrum, all of the latter have the colors many shades paler and grayer and the capistrum gray instead of black. In fact, *coccineus* presents exactly the opposite extreme from *igneus* in regard to the color of the throat, the difference from true *C. cardinalis* being, if anything, even greater. Besides, *coccineus* is always a decidedly smaller bird, the average difference in length of wing and tail amounting at least to .25 of an inch.

An important factor in the case has been unfortunately misunderstood by Messrs. Salvin and Godman, which is that of all birds possessing the power of flight the birds of this genus are perhaps the most sedentary. Even at the very northern extreme of its range, *C. cardinalis* is a winter resident, enduring, without apparent discomfort, a cold of —28°. And it is perhaps not too much to say that, except where transported accidentally, an individual of this species rarely, if ever, wanders so much as ten miles from the place of its birth!

Family ICTERIDÆ.

[34. *Dolichonyx oryzivorus* (Linn.). Devis collection.]

+ **35. Icterus cucullatus** Swains.

Two males, three females, the former apparently identical with Yucatan examples.

+ **36. Quiscalus macrourus** Swains.

Two specimens.

Family TYRANNIDÆ.

+ **37. Tyrannus dominicensis** (Gmel.).

One example.

+ **38. Tyrannus melancholicus couchi** (Baird).

Twelve specimens, not satisfactorily distinguishable from mainland examples, although they have purer ashy heads, grayer backs, and somewhat larger bills than most of the latter.

+ **39. Myiarchus platyrhynchus** Ridgw.

Myiarchus platyrhynchus, Ridgw. Descr. New Sp. B. Cozumel, February 26, 1885, 3.

Sp. char.—Similar to *M. barbirostris*, Swains., of Jamaica, but upper parts much grayer, the pileum not so dark, and the upper tail-coverts, rectrices, and wing-feathers edged with darker rusty.

Adult ♀ (No. 102,738, U. S. Nat. Mus., Cozumel): Above dull brown,

without olive tinge, darker on pileum; upper tail-coverts and edges of rectrices, remiges, and greater wing-coverts rusty. Chin, throat, and jugulum pale ash-gray; rest of lower parts very pale sulphur-yellow. Wing, 3.00; tail, 2.00; culmen, .85; bill from nostril, .50; width at base, .33; tarsus, .80; middle toe, .42.

This bird is so closely related to *M. barbirostris*, of Jamaica, that it should perhaps be considered merely a local race of it. However, the general coloration is very distinct on comparison; but to what extent this difference is due to action of alcohol on the feathers—the specimen having been preserved in spirits and afterwards skinned—is not known.

40. Contopus schottii Lawr.?

Four specimens, which uniformly differ from the type of *C. schottii* in decidedly grayer coloration above, with the pileum darker. They may represent a distinct form.

41. Empidonax gracilis Ridgw. (=*E. minimus*, Baird?)

Empidonax gracilis Ridgw. Descr. New Sp. B. Cozumel, February 26, 1885, 3.

Sp. char.—Most like *E. minimus*, but the plumage much grayer, the lower parts without yellow tinge.

Adult ♀ (No. 102,737, U. S. Nat. Mus., Cozumel, January 22): Above ash-gray, more brownish, but still decidedly gray, on lower back, rump, and upper tail-coverts; a distinct orbital ring, two broad wing-bands, and broad edges to tertials grayish-white; sides of head light ash-gray, fading to grayish white on throat; jugulum and sides of breast light brownish gray; rest of lower parts white. Wing, 2.50; tail, 2.20; culmen, .55; bill from nostril, .25; width of bill at base, .23; tarsus, .60; middle toe, .30.

This bird, of which a single specimen was collected and preserved in alcohol, so closely resembles the female of *E. minimus*, Baird, in dimensions as to cause a suspicion that it may be in reality a specimen of that species with all the yellow coloring abstracted from the plumage by the action of the alcohol in which it had been preserved before skinning. Still, the difference of coloration is much too great to allow of this hypothesis determining the question.

42. Elainea martinica (Linn.)?

Two specimens, one skinned from fresh bird the other from alcohol. The former I am unable to distinguish satisfactorily from some Dominica specimens; but the latter is very different in appearance, all the yellowish tints having been extracted from the plumage by the alcohol, leaving the color dull brownish gray above and dull pale gray or grayish white beneath.

43. Elainea placens Scl.?

Four examples, two skinned from fresh birds and two from alcohol. The former agree very closely with Guatemala specimens of *E. placens*,

but have the head rather more ashy and the whitish supercilium apparently more distinct. The latter, as in the case of alcoholic specimens of *E. martinica* and other species, are exceedingly different in appearance through extraction of the yellow coloring matter by the alcohol, leaving the plumage gray and yellowish white. More specimens, both from Cozumel and from the mainland, are required to determine the question as to whether they are identical or not.

Family COTINGIDÆ.

[44. *Hadrostomus*, species undetermined.]

Hadrostomus, sp.? SALV. Ibis, April, 1885, 191.

"A female or young male specimen of a species which I do not at present recognize. The bill is much larger than that of *H. aglaiæ*, of the adjoining coast. Nor does it agree with any specimens of *H. niger* that I have examined." (SALVIN, *l. c.*)

45. **Attila cozumelæ** Ridgw.

Attila cozumelæ, RIDGW. Descr. New Sp. Birds Cozumel, February 26, 1885.
Attila, sp.? SALVIN, Ibis, April, 1885, 191.

SP. CHAR.—Most like *A. citreopygia* (Bonap.), but lower parts grayish white, the throat and jugulum very indistinctly streaked with darker, the head much grayer, and the bill smaller.

Adult ♂ (type, No. 102,767, U. S. Nat. Mus., Cozumel, January 29, 1885): Pileum brownish gray, streaked with black, and also streaked with white on forehead; dorsal region deep raw-umber brown, lighter and more olivaceous on the cervix, deeper and more rufescent posteriorly, especially on upper part of rump; lower rump and upper tail-coverts ochraceous-yellow. Wings, in general, dusky, the lesser coverts and outer edges of tertials olive-brown; middle and greater coverts tipped with russet-brown, forming two tolerably distinct bands; primaries narrowly edged with grayish. Tail uniform raw-umber brown. Head, except on top, grayish white, streaked with grayish dusky, the auriculars tinged with yellowish olive. Chin and throat grayish white, indistinctly streaked with light gray; jugulum and breast grayish white or very pale gray, the darker streaks nearly obsolete, and the lateral portions, especially of jugulum, faintly tinged with olive-yellow; abdomen immaculate white; sides and flanks deep ochraceous; crissum primrose-yellow; longer lower tail-coverts yellowish white; lining of wing pale buff-yellow. Bill horn-color, darker on upper mandible, but paler at tip; feet apparently plumbeous in life. Wing, 3.65; tail, 3.40; culmen, 1.20; bill from nostril, .75; tarsus, 1.00; middle toe, .65.

Adult ♀ (No. 102,765, Cozumel, January 28): Similar to the male, as described above, but pileum decidedly more brown, grayish streaks on side of head, throat, etc., much more indistinct, sides much paler ochra-

ceous, and size decidedly smaller. Wing, 3.20; tail, 1.80; culmen, 1.10; bill from nostril, .68; tarsus, .97; middle toe, .60.

Five specimens, compared with a series of sixteen from the mainland of Middle America (including specimens labeled *A. citreopygia*, *A. sclateri*, and *A. cinnamomea*), are all colored like those described above, showing the difference from the mainland representative (or, more properly, representatives, since there appear to be two and possibly three species) to be not only very obvious but also exceedingly constant.

Family TROCHILIDÆ.

+46. **Trochilus colubris** Linn.

One specimen, obtained January 22.

+ 47. **Lampornis prevosti thalassinus** Ridgw.

Lampornis thalassinus, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 3.

SUBSP. CHAR.—Most like *L. prevosti* (Less.), but upper parts less bronzy or more of a grass green, the black of the throat more extended, and the breast more bluish green.

Adult ♂ (type, No. 102,796, U. S. National Museum, Cozumel, January 24): Above uniform metallic grass-green, with golden reflections in certain lights; middle pair of rectrices metallic bottle-green or bronze-green; rest of tail brilliant metallic violet-purple on a rich chestnut ground, the feathers bordered for terminal third, on both webs, with greenish black. Wing-coverts metallic bronze-green, like the back; remiges uniform blackish dusky, with a faint gloss of brownish purple in certain lights. Chin and throat uniform opaque velvety black, bordered along each side by brilliant metallic Paris green, this changing gradually on the jugulum to metallic sea-green, which gradually becomes less bluish toward the abdomen; sides and flanks bronzy green, like upper parts; exposed portion of lower tail-coverts dark chestnut, glossed with purple, and narrowly bordered terminally with dusky, the concealed portions of the feathers dull dusky greenish; anterior lower tail-coverts bright green. A line of white, downy feathers between flanks and rump. Bill and feet black. Wing, 2.60; tail, 1.55; culmen (to extreme base), 1.20, to frontal apices, 1.00.

Immature ♂ (No. 102,810, Cozumel, January 22): Above bronzy grass-green, much duller than in the adult. Rectrices, except middle pair, with basal two-thirds chestnut, richly glossed with metallic violet-purple, the terminal third blue-black (glossed with bronze-green on edges), the tip white. Lower parts chiefly white, divided medially by an irregular line or stripe extending from the middle of the throat to the anal region, this opaque velvety black anteriorly, the rest sea-green and dusky. Green of upper parts and white of lower surface separated, from rictus to sides of breast, by a somewhat broken stripe of deep cinnamon. Wing, 2.50; tail, 1.50; bill from frontal feathers, 1.00.

Adult ♀ (No. 102,811, Cozumel, January 22): Similar to the young male, as described above, but without any of the cinnamon along sides of throat, etc., the black of the middle line of the throat extending anteriorly to the point of the chin, and white of cheeks reaching almost to the lower eye-lid. Wing, 2.60; tail, 1.60; bill from frontal feathers, 1.05.

The examination of a larger series of this bird and *L. prevosti* than were compared when it was first described shows that it is not so distinct as at first seemed to be the case. The characters given in the original diagnosis will, in the main, be found to hold good, and the form may be considered as a fairly well-defined local race of *L. prevosti.*

48. Chlorostilbon forficatus Ridgw.

Chlorostilbon forficatus, Ridgw. Descr. New Sp. B. Cozumel, February 26, 1885, 3.
Chlorostilbon caniveti, Salv. Ibis, April, 1885, 191 (nec. *Ornismya caniveti*, Less.).

Sp. char.—Similar to *C. caniveti* (Less.), but tail much longer and more deeply forked. In ♂, length, 1.80–1.95 inches; depth of fork, .90–1.15 inches. In ♀, length, 1.50; depth of fork, .42.

Adult ♂ (type, No. 102,812, U. S. National Museum, Cozumel, January 23, 1885): Above brilliant golden grass-green, more luminous on forehead and crown; tail blue-black, the six middle feathers tipped with brownish slate; remiges dull purplish dusky. Lower parts luminous Paris green, the chin, throat, and jugulum more emerald. Bill dull brown on basal third (in dried skin), the terminal two-thirds (approximately) black; feet brownish black. Wing, 1.90; tail, 1.90, forked for 1.15, the lateral feather .42 longer than the next; bill from frontal feathers, .55.

Adult ♀ (No. 102,821, U. S. Nat. Mus., Cozumel, January 22, 1885): Above uniform metallic grass-green, including four median rectrices, which, however, are not so bright as the back and rump; lateral rectrix with tip for about .20 of an inch, and a band about .25 wide, commencing at 1.70 from the tip, pale brownish gray, the basal and subterminal spaces blue-black; second rectrix with basal half metallic green, the remaining half blue-black, tipped with pale brownish gray, the green interrupted on outer web by a spot of pale dull gray; third rectrix without any gray, even at tip, the terminal third blue-black, the basal two-thirds uniform green. Auriculars grayish white, bordered anteriorly and inferiorly by a broad band of dull greenish dusky, extending obliquely from the eye across the cheeks, and connecting with the green on the side of the neck. Lower parts, including lores and malar region, uniform grayish white, the sides, however, chiefly metallic green, like the back. Bill blackish, the basal two-thirds of the lower mandible light brownish. Wing, 1.95; tail, 1.45, forked for .40 of an inch; bill from frontal feathers, .62.

Thirteen specimens (nine males and four females) agree very closely among themselves in the characters presented above.

Not having a specimen of *C. auriceps*, Gould, for comparison, I am unable to state whether the Cozumel species is more nearly related to it or to *C. caniveti* (Less.). The three species (the males, at least) appear to differ only in proportions. There is certainly no appreciable difference in color between males of *C. forficatus* and those of *C. caniveti*; and Mr. D. G. Elliot says (Ibis, 1875, p. 169) that "in size and general color of plumage" *C. auriceps* and *C. caniveti* "are as nearly alike as can be; and specimens of *caniveti* possess as brilliantly colored crowns as any that can be found in *auriceps*, thus reducing the distinctive character of its name to *nil*." *C. auriceps*, according to Mr. Elliot (*l. c.*), "is remarkable for its narrow and greatly lengthened outer rectrices, which extend beyond those next to them .55 of an inch," and must therefore be distinct from *C. forficatus*.

Family PICIDÆ.

[**49.** *Dryobates scalaris* (Wagl.). Devis collection.]
Picus scalaris SALVIN. Ibis, April, 1885, 191.

+**50. Centurus dubius leei** Ridgw.
Centurus leei, RIDGW. Descr. New Sp. B. Cozumel, February 26, 1885, 3.
Centurus dubius, SALV. Ibis, April, 1885, 192 (nec *Picus dubius* Cabot).

SP. CHAR.—Similar to *C. dubius* (Cabot), but lower parts darker, and lower rump and upper tail coverts usually barred with black.

Adult ♂ (type, No. 102,777, U. S. Nat. Mus., Cozumel, January 28): Frontlet dull vermilion-red; crown, occiput, and cervix crimson, becoming gradually lighter, or more of a vermilion-red, on the lower part of the cervix, the crimson of the crown separated from the lighter red of the frontlet by a narrow band of pale buffy gray. Upper parts black, thickly marked with narrow undulated bars of soiled white, these bars about .05 of an inch wide and .08–.10 of an inch apart on the back, but much farther apart on the wings (.12–.15 of an inch). Primary-coverts immaculate black; primaries black, with a few irregular spots of white near the base, the 6th to 10th quills, inclusive, with narrow terminal margins of white. Lower part of rump and upper tail-coverts soiled white, everywhere narrowly barred with black, the bars about .05 of an inch wide and .15 of an inch apart. Tail uniform black, the outer feather (on each side) with two irregular narrow bars of brownish white across both webs near the tip, the exterior margin indented with white for nearly the terminal half. Sides of head and neck, and lower parts generally, plain smoky drab, lighter toward the chin, but especially before and above the eye, more olivaceous on the sides; abdomen bright vermilion-red; femorals, anal region, and lower tail-coverts barred with dusky and brownish white, the latter somewhat tinged with red. Bill black; feet dusky (olive-greenish in life?). Wing, 5.15; tail, 3.90.

Adult ♀ (No. 102,781, U. S. Nat. Mus., Cozumel, January 28): Similar to the male, as described above, but red of the head confined to the frontlet and cervix, the occiput and crown being smoky gray or light

drab, becoming gradually paler anteriorly. Wing, 5.10; tail, 3.65; culmen, 1.35.

Thirteen skins (five male and eight female), besides four alcoholic specimens, agree in the possession, to a greater or less extent, of the characters which separate this bird from its mainland representative (*C. dubius*), of which about a dozen specimens have been compared with the Cozumel series. In *C. dubius* the upper tail-coverts and lower part of the rump are invariably immaculate white, and the lower parts a rather light olive-gray. In *C. leei*, three of the five males and five out of eight females have both the lower rump and the upper tail-coverts decidedly varied (usually barred) with black, while the exceptional specimens have only the longer upper tail-coverts immaculate, and these usually with black shafts or other concealed markings. The lower parts are in every instance decidedly darker than in the mainland bird, the red of the abdomen also being much more intense.

+ **51. Centurus rubriventris pygmæus**, subsp. nov.

Centurus rubriventris SALVIN, Ibis, April, 1885, 192 (nec SWAINS.).

SUBSP. CHAR.—Differing from true *C. rubriventris* in decidedly smaller size, narrower white bars of the upper parts, and grayer coloration of the lower parts.

Adult ♂ (type, No. 102,791, U. S. Nat. Mus., Cozumel, January 28): Frontlet cadmium-yellow, paler and duller on the nasal tufts; forehead smoky white, passing gradually into light drab on the lores and sides of the pileum, the same color extending uniformly over the entire lateral portion of the head and neck, the chin, throat, and jugulum, and continued in a deeper, more olivaceous shade, over the breast and sides. Crown with an ovoid patch of bright crimson, about .70 of an inch long by .40 wide; cervix bright vermilion-red, tinged with orange at the lower edge, the two red areas brokenly confluent on the occiput. Upper parts black, the back and scapulars very narrowly barred with dingy white, the wings with broader, more distant bars of pure white; primary-coverts uniform black; primaries spotted with white near outer webs, the longer quills narrowly margined with white beyond their sinuations, the shorter (innermost) quills narrowly tipped, on outer webs, with white. Upper tail-coverts and lower part of rump immaculate white. Tail uniform black, the intermediæ with much of the basal half, of both webs, white, though this is mostly concealed by the upper coverts; outer pair of rectrices with terminal half barred, about half way across outer web, with white. Middle of abdomen bright vermilion-red; femoral region, anal region, and lower tail-coverts olivaceous-white, barred with blackish, the markings more sagittate on lower tail-coverts. Bill wholly black; feet dusky (olivaceous or plumbeous in life?). Wing, 4.00; tail, 3.00; culmen (exposed portion), .80; tarsus, .70.

Adult ♀ (No. 102,785, U. S. Nat. Mus., Cozumel, January 23): Similar

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to the male, but red of head confined to the cervix, the whole crown and occiput being smoky drab, more olivaceous on the nape. Wing, 3.90; tail, 2.80; culmen (exposed portion), .75; tarsus, .70.

Four males and the same number of females of this well-marked race of a very distinct little species are in the collection. In all of them the frontlet is bright cadmium-yellow (paler and duller in some females), in very striking contrast to the red of the crown or cervix. In the males, the red of the crown is very nearly separated from that of the cervix, by the encroachment of the olive-gray on the sides of the occiput. In all of the males and three of females, the middle pair of the rectrices are marked with white on the basal portion of *both webs*, the white being in all cases more extended on the inner web. In a single female (No. 102,789), the white is entirely confined to the inner web, and is reduced to a mark so small as to be almost concealed by the coverts. The length of the wing is exactly 4 inches in the males, and varies only from 3.85 to 3.90 in the females.

Two examples of true *C. rubriventris*, from Yucatan, measure as follows:

Museum and number.	Sex and age.	Locality.	Wing.	Tail.	Exposed culmen.	Tarsus.	Collector.
36803, U. S. Nat. Mus	♂ ad.	Merida, Yucatan	4.30	2.80	.85	.70	Dr. A. Schott.
——— Mus. G. N. L	♀ ad.	——— Yucatan	4.25	2.80	.70	.65	G. F. Gaumer.
	♂	(Unknown)	4.30	3.00	......	......	(Swainson's type.)

Family CUCULIDÆ.

52. Crotophaga ani Linn.

Two specimens. The occurrence of this West Indian species to the exclusion of *C. sulcirostris*, Swains., which is so numerous in Yucatan, is somewhat remarkable.

Family PSITTACIDÆ.

53. Chrysotis xantholora Gray.

Three specimens—two adults and one young. The latter is colored as follows:

Young (No. 100,119, U. S. Nat. Mus., Cozumel I., Yucatan, January): In general coloration like the adult, but differing as follows: Forehead and crown blue, instead of white; the feathers with a narrow terminal margin of black. The red of the orbital region is replaced by green, though indicated by a few scattered red feathers, belonging to the new moult. The black subauricular spot is wanting, as is also the red border of the fore-wing (*campterium*). The three outer primary coverts are

green (all being intense poppy-red in the adult).* The larger wing-coverts and tertials margined terminally with light yellowish green.

Family FALCONIDÆ.

54. Buteo brachyurus Vieill.

A young male, which may be described as follows:

Young ♂ (No. 102,855, U. S. Nat. Mus., Cozumel I., Yucatan, January 24, 1885): Upper parts nearly uniform dull dusky brown, the head rather darker, or blackish brown, much broken by white streaking, the whole basal portion of the feathers being white; feathers of nape and upper part of back also white beneath the surface, the division of the white and brown directly transverse; scapulars with decidedly but indistinctly lighter brown margins, these edgings inclining on some feathers to dull ochraceous. Outer surface of primaries uniform brownish black. Tail dull grayish brown, with indications, most distinct next the shaft, of about seven narrow dusky bands, the last of which is much broader than the rest. (These bands scarcely show at all when the tail is closed, except on the middle rectrices.) Tip of tail narrowly and indistinctly pale brownish gray. Forehead and anterior portion of lores immaculate white; sides of head, including superciliary and supra-auricular regions, suborbital region and auriculars, streaked with white and dusky, in nearly equal proportion; sides of neck similarly but more broadly streaked, and slightly mixed on the lower portion with rusty ochraceous. Entire lower parts, from chin to crissum, including the whole lining of the wing, axillars, and greater extent of under surface of remiges (in closed wing), immaculate white, the upper portion of outer side and whole of inner side of tibiæ deep creamy buff, or light ochraceous. Tail slightly emarginate when closed, truncate when spread; third and fourth quills longest, the others succeeding in the following order: 5th, 2d, 6th, 7th, 8th, 1st, 9th, 10th, the 1st and 8th being very nearly equal, however. Only three outer primaries with inner webs distinctly emarginated, but fourth showing an appreciable sinuation. Wing, 10.50; tail, 6.00; culmen, .68; tarsus, 2.30 (unfeathered portion 1.35); middle toe, 1.40.

55. Rupornis magnirostris gracilis Ridgw.

Asturina ruficauda SALV. Ibis, April, 1885, 193 (nec SCL. & SALV., P. Z. S. 1869, 133).

Rupornis gracilis RIDGW. Proc. U. S. Nat. Mus. VIII, May 20, 1885, 94.

SUBSP. CHAR.—Similar to *R. magnirostris griseocauda*, RIDGW.,† but

* Only the longest feather of the alula is present. In the adult the shortest (last) is red, like the primary coverts, and this feather is *probably* green in the young.

† *Buteo* (*Rupornis*) *magnirostris*, c. var. *griseocauda*, RIDGW., Proc. Boston Soc. N. H., May 21, 1874, 88.—*Rupornis magnirostris* (Gmel.), is a name which in all probability should cover a variable species, the range of which extends from southern Mexico to Bolivia and the Argentine Republic, and to the several more or less strongly characterized geographical races to which different specific names have been given. These

decidedly smaller, and with the thighs and under wing-coverts nearly or quite immaculate, instead of distinctly barred and spotted, respectively. Wing, 8.00–8.80 (average of the specimens, 8.44); tail, 6.00–6.30 (average, 6.13); culmen, .60–.72 (average, .67); tarsus, 2.20–2.40 (average, 2.33); middle toe, 1.05–1.20 (average, 1.17).

Male, nearly adult (type, No. 102,852, Cozumel, January 27, 1885): Upper parts nearly uniform grayish brown, the feathers with dusky shafts, and those of the dorsal region and wings with very narrow and rather indistinct paler margins, especially terminally; longer upper tail-coverts buff, or pale ochraceous, marked with sharply defined transverse, nearly reniform, spots of umber brown. Tail deep brownish gray, crossed by 4 bands of black, averaging about .50 of an inch wide, or nearly as wide as the brownish gray interspaces; the width gradually decreasing, however, from the last, or subterminal one, which is succeeded by a narrower

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races are (1) the true *magnirostris*, from South America north of the Amazon; (2) *Asturina nattereri*, Scl. & Salv., from Brazil and eastern Peru; (3) *Asturina ruficauda*, Scl. & Salv., from Central America (Isthmus of Panama to Nicaragua); (4) *Rupornis magnirostris griseocauda*, Ridgw., from southern Mexico and Guatemala, and (5) *R. magnirostris gracilis*, an insular form from the Island of Cozumel. To these it may hereafter prove necessary to add (6) *Asturina pucherani*, Verr., from the Argentine Republic, and (7) *A. saturata*, Scl. & Salv., from Bolivia. Intergradation between two of the above named forms has been proven in two instances, viz., between *magnirostris* and *nattereri* and between *ruficauda* and *griseocauda*, respectively; and in the case of the others, the relationship is so close that intergradation may safely be assumed. *A. saturata* apparently connects *nattereri* with *pucherani*, or at least has resemblances to both. Some authors have refused to recognize the validity of the form which I have named *griseocauda*, on the ground that intermediate specimens connect it with *ruficauda*; but in so ruling they utterly ignore the very distinction between species and geographical races, *i. e.*, the fact of intergradation in the case of the latter. Giving this distinction due consideration, it is found that *griseocauda* is just as well marked a race as any of the forms which have usually been ranked good species, but the circumstance that *ruficauda* and *griseocauda* are better represented, both numerically and as to locality, in collections than are the others, and that intermediate specimens are consequently more numerous, has rendered its distinctness less apparent.

The National Museum collection contains 23 adult specimens of *ruficauda* and *griseocauda* together; and the way in which the two forms intergrade, as shown by this series, is as follows:

Panama (1 specimen).—Tail-bands rufous.

Chiriqui (1 specimen).—Tail-bands rufous.

Costa Rica (8 specimens).—Tail-bands rufous in 4, chiefly rufous in 3, and gray mixed with rufous in 1.

Nicaragua (5 specimens).—Tail-bands with rufous predominating in 1, with gray predominating in 4.

Guatemala (1 specimen).—Tail-bands gray, but much tinged with rufous, especially on lateral feathers.

Yucatan (5 specimens).—Tail-bands gray in all; in 3 of them, the basal portion of the outer web of lateral rectrices mottled with pale ochraceous, and in 2 others the same portions tinged with rufous.

Tehuantepec (1 specimen).—Tail-bands gray, the outer web of lateral rectrices tinged with rufous at base.

Vera Cruz (1 specimen, from Mirador).—Tail-bands gray, the basal portion of the rectrices (except middle pair) tinged with rufous.

band of brownish gray, gradually passing into dull whitish at the terminal margin; extreme base of the tail (concealed by the coverts), buffy white, this becoming ochraceous-buff on the basal portion of the two lateral rectrices, on which this color occupies nearly the basal third. Primaries brownish dusky, all except the three outermost with a greater or less number of quadrate ferruginous spots, disposed in transverse bands. Whole side of head uniform grayish brown, somewhat paler than the pileum; extreme anterior portion of the forehead dull whitish. Chin and upper part of throat dull white, marked with narrow cuneate streaks of grayish brown; lower part of throat light buff, marked with similar, but larger streaks; jugulum and upper part of breast with grayish brown prevailing, but the feathers much spotted or otherwise marked on the edges with buffy white, forming broken or irregular longitudinal stripes; rest of lower parts buffy white, the entire sides, lower part of breast, and upper part of abdomen marked with sharply defined transverse spots, or broad, somewhat reniform, bars, of umber brown. Tibiæ deep ochraceous-buff, the upper half (or more) of the outer side marked with narrow bars of brown; crissum deep creamy buff, passing into buffy white on lower tail-coverts; lining of the wing light buff, sparsely marked with a few small spots and streaks of brown. Bill dusky, clouded with light horn-yellowish; feet apparently deep yellow in life. Wing, 8.20; tail, 6.00; culmen, .67; tarsus, 2.35; middle toe, 1.08.

Female, nearly adult (No. 182,849, U. S. Nat. Mus., Cozumel, January 27): Almost exactly like the male, as described above. Wing, 8.70; tail, 6.20; culmen, .70; tarsus, 2.35; middle toe, 1.15.

Young ♂ (No. 102,853, U. S. Nat. Mus., Cozumel, January 27): Upper parts much as in the adult, but pileum streaked with buffy white, the brown spots on upper tail coverts less transverse, or more cordate, and the brown tail-bands narrower and less grayish, a fifth rather indistinct dusky band showing beyond the tips of the upper tail-coverts. Primaries without ferruginous markings, but spotted, in transverse bands, with grayish brown instead. Lower parts pale buff, approaching white anteriorly, with no transverse markings, but the throat, jugulum, breast, and sides marked with longitudinal guttate and lanceolate stripes and streaks of deep brown, these streaks largest and broadest on the sides, smallest on the throat. Tibiæ ochraceous-buff, marked on the outer side with a few small cordate and triangular spots of grayish brown. Wing, 8.00; tail, 6.00; culmen, .60; tarsus, 2.35; middle toe, 1.12.

Young ♀ (No. 102,848, U. S. Nat. Mus., Cozumel, January 23): Essentially like the young male, as described above, but stripes on breast, etc., broader and rather paler brown, the markings on sides and flanks in the form of spots, arranged in chain-like series. Wing, 8.35; tail, 6.20; culmen, .70; tarsus, 2.40; middle toe, 1.10.

+56. **Urubitinga anthracina** Nitzsch.

One specimen, a fine adult, shot while feeding on a Curassow (*Crax globicera?*).

Family COLUMBIDÆ.

[57. *Columba leucocephala* Linn. Devis collection.]

[58. *Engyptila jamaicensis* (Linn.)? Devis collection.]

+59. **Columbigallina passerina** (Linn.).

Two specimens.

+60. **Columbigallina rufipennis** (Bp.).

Two specimens.

Family CRACIDÆ.

+61. **Crax globicera** Linn.?

Only a few remiges of a female specimen, upon which a *Urubitinga anthracina* had been feeding. These feathers are different from the corresponding ones of any example of *C. globicera* in the National Museum collection, but the latter species itself varies so much in coloring that nothing can be decided as to the status of the Cozumel bird without a complete specimen, or perhaps a series of specimens.

Family ARDEIDÆ.

62. **Garzetta candidissima** (Gmel.).

A fine adult, in full nuptial plumage.

Family CHARADRIIDÆ.

63. **Oxyechus vociferus** (Linn.).

One specimen.

Family SCOLOPACIDÆ.

64. **Actitis macularius** (Linn.).

One specimen.

In order to show the complicated relationships of the Cozumel bird fauna, the following list is presented, including all the species known to have been found there to date, together with their geographical distribution:

	Peculiar to Cozumel.	Peculiar to Cozumel and Yucatan or coast of Honduras.	North American species wintering in West Indies.	North American species wintering in Middle America.	North American species wintering in both West Indies and Middle America.	West Indian species.	Continental (tropical) species.	Genus peculiar to West Indies.	Genus not represented in West Indies.
Fam. SYLVIIDÆ.									
1. Polioptila cœrulea (Linn.)				*					*1
Fam. MIMIDÆ.									
2. Harporhynchus guttatus, Ridgw	*								*
3. Mimus gilvus gracilis (Cab.)		*							
4. Galeoscoptes carolinensis (Linn.)				*					*
5. Melanoptila glabrirostris, Scl		*2							*
Fam. TROGLODYTIDÆ.									
6. Troglodytes beani, Ridgw	*								*
Fam. MNIOTILTIDÆ.									
7. Mniotilta varia (Linn.)					*				
8. Compsothlypis americana (Linn.)					*				
9. Dendroica petechia rufivertex, Ridgw	*								
10. Dendroica virens (Gmel.)				*					
11. Dendroica cœrulescens (Linn.)					*				
12. Dendroica maculosa (Gmel.)				*					
13. Dendroica dominica albilora, Baird				*3					
14. Dendroica palmarum (Gmel.)			*						
15. Dendroica discolor (Vieill.)			*						
16. Seiurus noveboracensis notabilis, Ridgw				*					
17. Seiurus aurocapillus (Linn.)					*				
18. Geothlypis trichas occidentalis, Brewst				*					
19. Sylvania mitrata (Gmel.)					*				
20. Setophaga ruticilla (Linn.)					*				
Fam. CŒREBIDÆ.									
21. Certhiola caboti, Baird	*								
Fam. VIREONIDÆ.									
22. Vireo cinereus, Ridgw	*								
23. Vireo flavifrons, Vieill				*					
24. Vireo noveboracensis (Gmel.)				*					
25. Vireo bairdii, Ridgw	*								
26. Cyclorhis insularis, Ridgw	*								*
Fam. TANAGRIDÆ.									
27. Spindalis benedicti, Ridgw	*							*	
28. Piranga roseigularis, Cabot		*4							*
Fam. FRINGILLIDÆ.									
29. Ammodramus savannarum passerinus (Wils.)			*						
30. Passerina cyanea (Linn.)				*					*
31. Passerina ciris (Linn.)				*					
32. Euetheia olivacea intermedia, Ridgw	*								
33. Cardinalis cardinalis saturatus, Ridgw	*								*
Fam. ICTERIDÆ.									
34. Dolichonyx oryzivorus (Linn.)			*						
35. Icterus cucullatus, Swains							*		
36. Quiscalus macrourus, Swains							*		
Fam. TYRANNIDÆ.									
37. Tyrannus dominicensis (Gmel.)						*			
38. Tyrannus melancholicus couchi (Baird)							*		
39. Myiarchus platyrhynchus, Ridgw	*								
40. Contopus schottii, Lawr. ?		*4							
41. Empidonax gracilis, Ridgw	*								
42. Elainea martinica (Linn.) ?						*			
43. Elainea placens, Scl. ?							*		

[1] A peculiar species in Cuba (*P. lembeyi*).
[2] Not yet found in Yucatan.
[3] The typical form resident in West Indies.
[4] Known only from Cozumel and Yucatan.

	Peculiar to Cozumel.	Peculiar to Cozumel and Yucatan or coast of Honduras.	North American species wintering in West Indies.	North American species wintering in Middle America.	North American species wintering in both West Indies and Middle America.	West Indian species.	Continental (tropical) species.	Genus peculiar to West Indies.	Genus not represented in West Indies.
Fam. CONTINGIDÆ.									
44. Hadrostomus (undetermined)	*?								
45. Attila cozumelæ, Ridgw	*								*
Fam. TROCHILIDÆ.									
46. Trochilus colubris, Linn				*					*
47. Lampornis prevosti thalassinus, Ridgw	*								
48. Chlorostilbon forificatus, Ridgw	*								*
Fam. PICIDÆ.									
49. Dryobates scalaris (Wagl.)							*		*
50. Centurus dubius leei, Ridgw	*								
51. Centurus rubriventris pygmæus, Ridgw	*								
Fam. CUCULIDÆ.									
52. Crotophaga ani, Linn						*			
Fam. PSITTACIDÆ.									
53. Chrysotis xantholora, Gray		*							
Fam. FALCONIDÆ.									
54. Buteo brachyurus, Vieill							*		
55. Rupornis magnirostris gracilis, Ridgw.	*								
56. Urubitinga anthracina, Nitzsch						*?[1]	*		
Fam. COLUMBIDÆ.									
57. Columba leucocephala, Linn						*			
58. Engyptila jamaicensis (Linn.)?[2]						*			
59. Columbigallina passerina (Linn.)						*	*		
60. Columbigallina rufipennis (Bonap.)							*		
Fam. CRACIDÆ.									
61. Crax globicera, Linn.?							*		*
Fam. ARDEIDÆ.									
62. Garzetta candidissima (Gmel.)						*	*		
Fam. CHARADRIIDÆ.									
63. Oxyechus vociferus (Linn.)					*				
Fam. SCOLOPACIDÆ.									
64. Actitis macularius (Linn.)					*				

[1] The West Indian bird possibly distinct, as *U. gundlachi* (Cab.).
[2] =*E. gaumeri*, Lawr., but apparently not sufficiently distinct from the Jamaican bird.

RECAPITULATION.

Species or subspecies peculiar to Cozumel	19
Species or subspecies peculiar to Cozumel and Yucatan or coast of Honduras	5
North American species wintering in West Indies	4
North American species wintering in Middle America	12
North American species wintering in Middle America and West Indies	8
West Indian species	5
Species common to Middle America and West Indies	3
Continental (tropical) species	8
Total	64
Genera peculiar to West Indies	1
Genera not represented in West Indies	14

CONTRIBUTIONS TO THE HISTORY OF THE COMMANDER ISLANDS.

No. 5.—Description of a new species of Mesoplodon, M. Stejnegeri, obtained by Dr. Leonard Stejneger, in Bering Island.

By FREDERICK W. TRUE.

(Accompanied by two figures.)

Among the specimens collected by Dr. Leonhard Stejneger in the Commander Islands in 1883 is the cranium of a young *Mesoplodon*, which belongs to a species apparently hitherto undescribed. The skull is quite badly water-worn. The tympanic and malar bones are wanting and the pterygoids are very imperfect. The beak apparently wants a few millimeters of its original length.

In his admirable monograph of the genus *Mesoplodon*, Professor Flower succinctly contrasts the characters of the different species. The characters to which he draws attention concern the basi-rostral groove, the maxillary and premaxillary foramina, and the teeth. The characters of the teeth cannot be brought into service in connection with our specimen, since the mandible is unfortunately wanting Following Professor Flower, the known species may be divided into two groups: (1) those in which the basi-rostral groove is absent or slight and the foramina of the premaxillary and maxillary bones are level; and (2) those in which the groove is deep and the premaxillary foramen is behind the maxillary foramen. Between these two groups the Bering Island skull is intermediate, for while the basi-rostral groove is absent, the premaxillary foramen stands behind the maxillary foramen.

In general proportions the Bering Island skull agrees closely with *M. Hectori*, as is evident from the following table of comparative measurements:

Measurements.	M. Hectori. From Flower. (T. Z. S., X, p. 424).		M. Stejnegeri, sp. nov. No. 21112.	
	Millimeters.	Hundredths.	Hundredths.	Millimeters.
Total length	567	100.0	100.0	633
Length of beak	320	56.4	55.8	353
Breadth of beak at base of notches	135	23.8	21.2	134
Breadth of beak at its middle	37	6.5	7.3	46
Greatest breadth of premaxillæ proximally	117	20.6	18.6	118
Breadth of anterior nares	51	8.9	8.8	56
Extremity of beak to hinder margin of pterygoids in median line	442	77.9	....	....
Greatest height of cranium from vertex to pterygoids	241	42.5	42.9	272
Breadth between centers of upper margins of orbits	235	41.5	44.1	279
Breadth between zygomatic spurs of squamosal	259	45.7	44.6	282
Breadth of occipital condyles	92	16.2	15.8	100

Though the skull figured by Professor Flower (*l. c.*, pl. lxxi, fig. 4; lxxii, fig. 4) is somewhat smaller than ours, the two appear to be of about the same age, and comparisons of part with part are therefore

admissible. In *M. Hectori*, as figured by Professor Flower, the premaxillary foramen lies in a groove, which is considerably prolonged anteriorly. In our specimen the groove extends behind but not in front of the foramen. The premaxillæ themselves begin to assume a perpendicular position immediately in front of the foramen. In these respects the Bering Island specimen shows some affinity to *M. Grayi*. The lateral expansion of the proximal ends of the premaxillæ is relatively less in *M. Hectori*, much less than in the other species. The extension of these bones on the horizontal surface of the maxilla opposite the nares is much less than in *M. Hectori*. The palatine bones are well developed and extend in front of the pterygoids on the "palate." The vomer is visible in the middle third of the lower surface of the beak, as in *M. Hectori*. The exposed portion is 66 millimeters in length.

Viewed from the side, the contour of the occipital in the Bering Island specimen is seen to be very decidedly less convex than in *M. Hectori*, as figured by Professor Flower. The occipital would appear to be flatter than in any of the known species of the genus; superiorly it is concave. Though the sides of the beak are much broken, it is evident that there is no basi-rostral groove in this species.

A section of the beak at the middle has an outline quite different from any of those figured by Professor Flower (*l. c.*, p. 422). Omitting the intermaxillæ, which stand vertically, the outline of the remainder of the section is approximately a circle.

As this species appears to be distinct from any hitherto described, I propose for it the name of *Mesoplodon Stejnegeri*, in honor of my esteemed friend, the eminent naturalist, Dr. Leonhard Stejneger.

Diagnosis of Mesoplodon Stejnegeri, sp. nov.

External form unknown.

Skull.—Brain-case little less than half the length of the skull. No basi-rostral groove. Premaxillary foramen posterior to the maxillary foramen. Premaxillary bones not grooved in front of the foramen, assuming a nearly vertical position anterior to the middle of the beak; not greatly expanded laterally back of the nares. Occipital bone plane above the condyles, concave at the vertex. Exposed portion of vomer less than one-fifth the length of the beak.

Habitat: Bering Sea.

WASHINGTON, *September* 25, 1885.

A NOTE UPON THE HYPEROODON SEMIJUNCTUS OF COPE.

By FREDERICK W. TRUE.

The skeleton upon which Professor Cope based his *Hyperoodon semijunctus* having recently been transferred, through the courtesy of Dr. G. E. Manigault, curator of the Charleston College Museum, to the national collection, I have taken pains to examine it with the special view of determining if possible the identity of the species.

The specimen is very young. In the skull the basi-sphenoidal suture is open and the outlines of the elements of the occipital bone are still faintly marked. All the bones are very brittle and many are badly broken. Phalanges and pelvic and hyoid bones are wanting.

I find no flaw in the brief original description by Professor Cope. Of the 10 pair of ribs, however, that belonging to the right side has been lost. The total number of vertebræ is 47, but the last three are restorations in wood. About that number are needed, however, to properly complete the backbone.

The specimen is unquestionably a *Ziphius*, and the opinions of Professors Flower and Van Beneden in regard to it are, therefore, sustained. Whether it is distinct from *Z. cavirostris* or not I am unable to determine. My observation leads me to believe that in this genus the changes in the conformation of the skull in front of the anterior nares, as a consequence of age, rival those affecting the maxillary crests in *Hyperoodon*. There appears to be a progressive excavation or absorbtion of the bones lying in the median line of the upper surface of the beak, accompanied by introvertion of the premaxillæ and a rounding off of the extremity of the beak. Until it has been determined how far these changes are due to age it would seem impossible to decide upon the real number of existing species. It is perhaps desirable that the Charleston specimen should for the present be known as *Ziphius semijunctus*.

In general form and proportion the skull approaches most closely the *Z. Gervaisii* of Duvernoy (fig. in Van Beneden and Gervais, Osteog. Cétacés, pl. 21, figs. 1–6). It is least like the *Z. indicus* of Van Beneden. Its proportions are as follows:

Measurements of the skull of Ziphius semijunctus (Cope).

[No. 21,975.—Type —.]

Measurements.	Millimeters.	Measurements.	Millimeters.
Total length	797	Breadth between hinder margins of temporal fossæ	244
Length of beak	466	Length of temporal fossa	124
Breadth of beak at base of notches	252	Depth of temporal fossa	72
Breadth of beak at its middle	82	Total length of mandible	678
Height of beak at its middle	54	Length of symphysis of mandible	
Breadth of premaxillæ at same point	40	Length of tooth-row of mandible	
Greatest breadth between outer margins of premaxillæ proximally	147	Depth between angle and coronoid process	134
Length of tooth-line		Total length of mandibular tooth	46
Last tooth to base of maxillary notch		Greatest diameter of mandibular tooth	11
Tip of beak to anterior margin superior nasal opening		Vertex to lower margin occipital condyles	280
Tip of beak to end of crest of pterygoid in median line	620	Horizontal length of nasals	95
Breadth between orbital processes of frontal	395	Greatest width of both nasals	57

WASHINGTON, *September* 25, 1885.

FRESH-WATER SPONGES FROM MEXICO.

By EDWARD POTTS.

Meyenia plumosa, Carter, var. *Palmeri*, n. v.

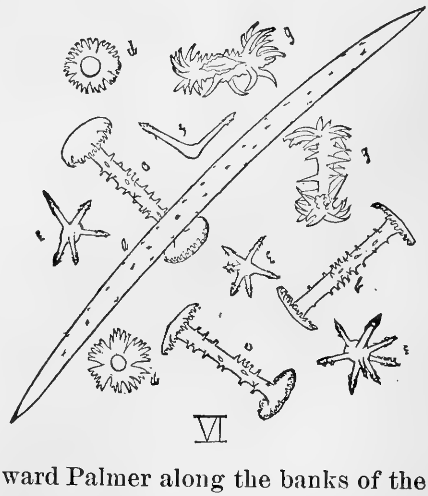
Sponge (as seen in a dry state) dark brown, massive, attached to and surrounding the dependent branches of small trees, whose stems are flooded by the spring freshets. Texture very loose, and when dry so brittle that the dermal surface cannot be satisfactorily examined. (The impression conveyed by the interior appearance of this sponge is that it is made up of an infinite number of radiating confluent branches.)

Gemmulæ large, numerous throughout the deeper portions of the sponge; subspherical or ovoid, surrounded by long birotulates imbedded in a granular crust.

Skeleton spicules straight or slightly curved, mainly cylindrical but gradually sharp-pointed, sparsely microspined.

Dermal spicules irregularly stellate as in the typical species, but in the specimens examined much fewer in number. They vary from simple acerates with one or more long divergent branches to beautiful radiate spherical bodies whose rays are nearly equal, spined, and capitate by reason of recurved spines at their extremities. Another form of spicule, probably also dermal, of which several are seen upon nearly every slide prepared for microscopic examination, is very difficult of description. It may be said to be composed of an irregular series of smooth curved rays arising from a nearly common center, and is somewhat suggestive of a hedgehog or Scotch terrier.

Birotulate spicules pertaining to the gemmulæ, in length about three times the diameter of the supported rotules; shafts cylindrical, plentifully spined; spines long, conical. Outer surface of rotules convex, margins lacinulate; ends of incomplete rays obtuse, recurved.



VI

Sponge masses subspherical, reaching five or six inches in diameter.

The plate represents: *a*, skeleton spicule; *b*, *c*, *c*, birotulate spicules of the gemmule; *d*, *d*, ends or rotules of the same; *e*, *e*, *e*, *f*, dermal spicules; *g*, *g*, abnormal forms frequently observed. The spicules are magnified 200 diameters.

This sponge, collected by Dr. Edward Palmer along the banks of the Colorado River, near Lerdo, Sonora, in Northwestern Mexico, about

59 miles SSW. from Fort Yuma, California, is a valuable addition to the sponge fauna of this continent, and interesting from the fact that the typicalspecies, *M. plumosa* of Carter, has heretofore only been found in his original locality, the rock water-tanks of Bombay, East Indies. That it should skip a whole hemisphere and only be found the second time at its own antipodes is indeed remarkable.

The lower reaches of the Colorado of the West extend for miles through a region described by the collector as "the hottest, driest, and most barren in the United States," whose "vegetation consists of mesquit, cacti, and the screw-bean, *Strombocarpus pubescens*." Its normal border lands are known as the "first" and "second" "bottoms," of which the latter is the higher and of course more distant from the channel. By the frequent changes in its bed, however, the river cuts through these, and, washing away the one and filling up the other, reverses their physical conditions. Upon the "second bottoms," then, said to be only reached to any considerable depth by the annual floods occurring during parts of May and June, and not to continue flooded more than six weeks at a time, the screw-bean abounds. It is described as a small tree of the general appearance of a peach tree, but with more slender drooping branches. More or less of an alkaline deposit whitens the ground upon which they grow, and the approaching traveler is puzzled to see in strong contrast with it hundreds or even thousands of dark masses, "like wasp's nests," suspended two or three feet above.

It was this conundrum that confronted Dr. Palmer during his recent visit, and the answer we have in the sponge before us. From the Amazon River in the tropics to the waters of Maine and Nova Scotia in the temperate regions of the north, sponges have long been known to affect the pendent branches of stream-bordering bushes; but it is unlikely that they have ever before been observed in such quantities suspended for nine or ten months of the year over land parched and desolate.

On referring to the earlier descriptions of his discoveries by H. J. Carter, Esq., F. R. S., we find that though he collected this species on two or more occasions, the fragments were always found detached from their place of growth and floating upon the surface in the water-tanks referred to, about one month after the rainy season had commenced. He believed that the vitality of the gemmules was preserved during the dry season, notwithstanding their exposure to the sun and desiccating winds, and that their germination after the water had again reached them was followed by a very rapid growth of new sponge. This would seem to have been the case also with the present variety, as, according to the reports of the collector, the masses could not have been submerged for a greater period than six weeks in any one year. Whether the whole bulk as now seen was attained during a single season, or is the cumulative result of several annual growths of the persistent masses, cannot now be determined.

It is worthy of notice that *M. plumosa* and this variety V. *Palmeri*, differ from all other known fresh-water sponges by the presence in them of a compound or substellate dermal spicule. The spiculæ of the dermis throughout the group are generally minute, spined acerates; in *M. Everetti*, Mills, we find them as minute birotulates. In *this* species the two forms seem to be combined; the spines have become central and prolonged, while their capitate extremities suggest the rotules of the last-named species.

Of the six sponge masses from the above locality, sent by the Smithsonian Institution for examination, the smallest was somewhat fusiform in shape and proved to belong to a different species—*Meyenia crateriforma*, Potts—heretofore found along the eastern border of the United States. In it alone the mass was not darkened by the presence of some pervading vegetable parasite.

DESCRIPTIONS OF NEW FISHES OBTAINED BY THE UNITED STATES FISH COMMISSION MAINLY FROM DEEP WATER OFF THE ATLANTIC AND GULF COASTS.

By G. BROWN GOODE and TARLETON H. BEAN.

A preliminary study of the collections of deep-sea fishes made under Government auspices has brought to light many new forms, some of which are here described in advance of their consideration in a final report now in preparation upon the extensive materials brought together by the combined efforts of the U. S. Fish Commission and the Museum of Comparative Zoology. Only the species secured by Fish Commission vessels are at present referred to, the rest being reserved for future discussion.

Aphoristia diomedeana, n. s.

The species is described from a specimen (No. 37347) from Albatross station 2414 (latitude 25° 04′ 30″ N., longitude 83° 21′ 15″ W.; depth, 24 fathoms). Its length is 140 millimeters to base of caudal. The body is somewhat slender, its greatest height (43^{mm}) contained $3\frac{1}{3}$ times in its length without caudal.

Scales moderate, somewhat loosely fixed, pectinated; about 85 in a longitudinal, 35 in a transverse, series. Jaws and snout covered with small thin scales.

Length of head contained $5\frac{2}{3}$ times in the standard length. Length of snout 5 times in that of head. Eyes moderate, equal, very close together, without intervening scales; the upper eye is *directly above the lower one*, and is distant from the dorsal outline an interval equal to its own least diameter; diameter of eye in length of head 6 times.

Mouth oblique, curved, its angle in the vertical through the front margin of the eyes; length of gape equal to that of snout, and con-

tained 5 times in that of head. Teeth very feeble. Nostrils tubular, nearer to eye than to tip of snout.

Dorsal origin in the vertical through middle of eyes; the fin contains 96 rays, including half of caudal, the length of the longest $3\frac{1}{2}$ times in greatest height of body.

Distance of anal origin from snout $4\frac{1}{4}$ times in total length; the anal contains 79 rays, and its greatest height is equal to that of the dorsal.

Length of median caudal rays contained 10 times in total length.

Distance of ventral origin from snout 6 times in total length; the ventral is separated from the anal by a distance equal to one-third the length of head; its length is contained $2\frac{2}{3}$ times in that of head; it consists of four rays.

Color uniform gray, lighter below, the scales above somewhat metallic in luster. The last fourth of the dorsal has three oblong black blotches somewhat larger than the eye; the anal with four similarly placed. In the young there is a slight brownish marginal line upon each scale, and an appearance of indistinct cloudings of brown upon the colored side.

Radial formula: D. 96; A. 79; V. 4; scales 85–35.

Aphoristia pusilla, n. s.

The species is described from the following specimens collected by the steamer Fish Hawk:

No. 28730, latitude 40° 07′ 48″ N., longitude 70° 45′ 54″ W., 55 millimeters long, with specimen 28778, latitude 40° 01′, longitude 69° 56′.

The body is slender, lanceolate, its greatest height contained $3\frac{1}{2}$ times in its total length. The scales are small, strongly and sharply denticulated, 85 to 90 in a longitudinal and 38 in a transverse series. Jaws and snout entirely covered with scales.

The length of the head is contained 5 times in total length; the length of the snout in that of the head $5\frac{1}{2}$ times, and equals the diameter of the eye.

Eyes small, very closely approximated, in the same vertical line. The nostril is tubular, placed midway between the lower eye and the tip of the snout.

Mouth small, oblique, curved, its posterior angle under the anterior margin of the pupil of the lower eye, the length of its gape in that of the head $4\frac{2}{5}$ times, in greatest height of body $6\frac{2}{5}$ times. Dentition feeble.

The dorsal fin begins in the vertical through the pupils and is composed of 78 rays; its greatest height is contained $2\frac{2}{3}$ times in that of body.

The anal is separated from the snout by a distance about equal to the height of the body, and $7\frac{1}{2}$ times the length of the snout. It has 70 rays; its greatest height equals one-third that of body.

The median caudal rays are short, their length contained eleven times in total.

The distance of the ventral from the snout is contained about $4\frac{1}{2}$ times in total length of body; its length equals twice the diameter of the eye. Its distance from the anal equals twice the diameter of the eye.

Color, light-brown, with six or seven cross-bars of slightly darker hue. Blind side light.

Hemirhombus fimbriatus, n. s.

The length of the individual described, to origin of middle caudal rays, is 213 millimeters.

Body elliptical; its height (102^{mm}) nearly half the body length.

Scales cycloid, about 70 in the longitudinal series, 25 or 26 in the vertical series above the lateral line, 31 below. The lateral line is slightly curved over the pectoral, the length of the arc of the curve contained $3\frac{1}{3}$ times in its straight portion. Vertical fins not scaly.

Length of head (61^{mm}) about $3\frac{1}{2}$ times in standard length. Length of snout ($11\frac{1}{2}^{mm}$), $5\frac{1}{4}$ times in that of head.

Mouth very large, with upper jaw strongly curved, lower jaw included. The length of the maxillary (30^{mm}) equals half the length of the head. The lower jaw extends behind the vertical through the posterior margin of the eyes; its length (36^{mm}) equal to that of postorbital part of the head, and contained 6 times in the total length. Edge of mandible and margin of suboperculum provided with a pointed flap of thin integumentary tissue. Gill-rakers very short, tubercular; about 9 on the anterior arch below the angle. The upper eye is placed at a distance from the dorsal profile equal to half its own diameter, which is a little more than one-fifth the length of the head, and is equal to that of its mate. Eyes in the same vertical and separated by an interspace equal to one-fourth the orbital diameter. Interorbital ridge low.

Nostrils on the line of the interorbital ridge; the anterior is equidistant from the tip of the snout and the margin of the upper eye; it is in a very inconspicuous tube, provided with a slender filament about one-third the length of the snout. The posterior nostril is separated from the anterior one by a space equal to one-fifth the length of the snout.

Teeth uniserial in both jaws, some of the anterior ones in the upper jaw being much larger than those following, while those in the lower jaw are still larger than these. Some of the teeth in each jaw are depressible.

The dorsal fin begins on the snout, in advance of the nostrils; the first ray longer than the second. The longest rays are behind the middle of the fin, their length (26^{mm}) one-fourth the height of the body. Eighty rays compose the fin.

The anal fin begins under the axil of the pectoral. Its longest rays behind its middle, their length (30^{mm}) greater than that of longest dorsal rays. It contains 60–61 rays.

Caudal with middle rays produced, the length of the median rays (45^{mm}) contained $4\frac{4}{5}$ in total length.

The greatest length of the pectorals (39^{mm}) is contained $5\frac{1}{2}$ times in total length.

The ventral of the colored side is on the ridge of the abdomen, on a line with its mate, which is slightly removed from the median line. Its distance from snout (56^{mm}) a little more than one-quarter the length of the body. Its length (23^{mm}) equal to half the length of median caudal rays. The ventral of the blind side is continued by a thin membrane to the vent, which is slightly distant from the edge of the abdomen, and behind the origin of the anal.

Color, grayish-brown; the dorsal and anal fins each with two roundish dark blotches upon their posterior halves, which are slightly larger than the eye. A similar dark blotch upon the middle of the caudal, sometimes with smaller blotches irregularly placed near its outer margin.

Pectoral, with a very narrow dark band near its base; the whole of its outer half is marked by a dark blotch, reticulated and mottled with lighter; the intervening portion is pearly-white, with dark specks upon the rays. Blind side cream colored.

D. 80; A. 60–61; P. 10; V. 6; C. 16.

List of specimens.

Catalogue number.	Station.	North latitude.	West longitude.	Fathoms.	Collector.	Remarks.
		° ′ ″	° ′			
37330	2403	28 42 30	85 29	88	Albatross...	Type.
37331	2407	28 47 30	84 37	24	.....do......	2 specimens.

The examples obtained are all from the Gulf of Mexico, between the delta of the Mississippi and Cedar Keys, Florida.

Citharichthys ventralis, n. s.

Extreme length of specimen described (117^{mm}). It is from Albatross station 2386, north latitude 29° 15′, west longitude 88° 06′, depth 60 fathoms. The catalogue number is 37343.

The height of the body (50^{mm}) is contained about $2\frac{1}{3}$ times in total length without caudal, and is equal to about $4\frac{1}{2}$ times the length of the tail (11^{mm}), and about 9 times its thickness ($5\frac{1}{2}^{mm}$).

The scales are ovate, strongly ctenoid, the longest about 3 millimeters in diameter, the diameter less than half that of the eye. The scales are firmly fixed. There are 66 scales in the lateral line (on the colored side), 19–21 of these in the curved portion, which is bold and sharply defined, and 19 above and 23 below the lateral line at the broadest part of the body. The length of the head (29^{mm}) is one-fourth that of the body, and $3\frac{5}{8}$ times the diameter of the eye. The interorbital space is very narrow, scaleless, its width equal to one-eighth diameter of eye. The length of the mandible (16^{mm}) is twice the diameter of the eye. The length of the maxillary (13^{mm}) less than half that of head.

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The dorsal fin begins on the snout upon the blind side and in advance of the eyes. Its greatest height (15^{mm}) about equal to length of mandible. It is composed of 93 simple rays.

The anal begins under the axil of the pectoral, its longest ray equal to or slightly exceeding half the distance of its anterior ray from the snout. It is composed of 73 simple rays.

Color light-brownish gray; a dark blotch, as long as the eye, on the anterior rays of the anal; another of lighter hue at the junction of the curved and straight portion of the lateral line. A few obscure blotches on different parts of the body. The caudal is subsessile, composed of 17 rays; its length (24^{mm}) a little less than half the height of the body, and equal to length of head without snout.

The pectorals are inserted considerably below the origin of the lateral line, and close to the gill-opening. That on the colored side is composed of 11 rays, its length (19^{mm}) nearly one-sixth of the total length; that of the blind side composed of 7 or 8 rays, the longest (28^{mm}) almost as long as the head.

The ventral consists of 6 rays. The length of the ventral of the eyed side (11^{mm}) is about one-third that of the blind side (34^{mm}). Females have the ventral of the blind side not enlarged.

Etropus rimosus, n. s.

Length of type (to base of caudal) 100 millimeters. Body pear-shaped, its height (54^{mm}) slightly exceeding half its length.

Scales large, strongly pectinated on both sides, about 41 in the longitudinal series, 12 above and 14 below the lateral line. Lateral line equally developed on both sides, very slightly curved above the pectoral. Head entirely covered with scales. Numerous small supernumerary scales between the normal scales covering their surface.

Length of head (24^{mm}) slightly less than one-fourth of the total length. Snout very short, its length (3^{mm}) 8 times in that of head. Mouth very small, its cleft less than diameter of orbit, its angle reaching about to vertical through anterior margin of lower eye.

The length of the maxilla (5^{mm}) somewhat less than one-fourth that of head. Length of mandible considerably more than one-third of the same length.

Teeth well developed on blind side in both jaws, also on the colored side of lower jaw in front.

Eyes moderate (7^{mm}), their diameter contained nearly $3\frac{1}{2}$ times in length of head, placed in the same vertical, the upper eye close to the dorsal profile, and separated from its mate by a space less than one-third of its own diameter. Interorbital ridge low.

Nostrils in line with the interorbital ridge, each in a short tube, the posterior being the larger. The anterior nostril is equidistant from the

tip of the snout and the lower orbit. Dorsal fin commencing at a point upon the blind side of the snout in the vertical through the anterior margin of the eye, containing 77–78 rays, the longest somewhat behind the middle of the fin, its length about 7 times in total length.

Anal fin commencing under the base of the pectoral, composed of 61 rays, the longest post-medial, as long as the longest in the dorsal. Anal papilla prominent.

Caudal fin rounded, the middle rays about as long as the head.

Pectorals normally placed, that upon the colored side longest, equal in length to that of the head without the snout.

Ventral of eyed side on ridge of abdomen, its base rather long but not reaching anal origin; that of blind side farther forward, its length equal to that of its mate, and a little more than one-tenth of the total. Vent at the anal origin slightly lateral.

Color, gray, hoary above with a few irregularly placed indistinct brownish blotches, none of which are larger than the eye. White below.

Radial formula: D. 77–78; A. 61; V. 6; P. 9–11; C. 17; scales, 41.

The types are numbered 37332; they are from station 2408, Albatross, north latitude 28° 28′, west longitude 84° 25′, depth 21 fathoms.

Macrurus caribbæus, n. s.

Many specimens of this new species were obtained by the Albatross. The type, number 37333, is selected from a number obtained at Station 2377, in the northern part of the Gulf of Mexico, at a depth of 210 fathoms. Its length is 290 millimeters.

In general appearance it resembles *M. atlanticus*, from which it may be quickly distinguished by its sharper and longer snout, smaller scales, more advanced second dorsal, and many other less prominent characters.

The body is normal in shape, its greatest height (44^{mm}) $6\frac{1}{2}$ times in total length.

Scales moderate, strongly denticulated, about 124 in the lateral line, 6 series between origin of dorsal and lateral line, and 15 or 16 series from vent forward to lateral line.

Length of head (65^{mm}) nearly $4\frac{1}{2}$ in total.

Interorbital area flat, its greatest width (13^{mm}) about 5 times in the length of the head. Postorbital portion of head (21^{mm}) about 3 times in length of head, as long as eye, which is oval, its horizontal diameter (21^{mm}), and $1\frac{2}{5}$ times as long as its vertical diameter (15^{mm}).

Snout long, thin, diaphanous, with acuminate point, its general form resembling that of *M. atlanticus*. Nostrils close to the orbit, the posterior one much the larger.

Teeth in both jaws in viliform bands, minute.

Barbel slender and short, its length (7^{mm}) $\frac{1}{3}$ that of the eye

The maxilla extends to the vertical through middle of pupil. Length of upper jaw (19^{mm}) slightly more than 3 times in length of head. Length of mandible (26^{mm}) $2\frac{1}{2}$ times in length of head.

First dorsal with two spines, the first minute, the second smooth,

elongate, and 8 rays, the last double, inserted at a distance from snout (72^{mm}) equal to one-fourth of the total length. The second spine (39^{mm}) reaches the fifth ray of the second dorsal. The length of dorsal base (15^{mm}) equals three-fourths of the space between the two dorsals.

The second dorsal begins in the perpendicular from the seventh ray of the anal and at a distance from the first dorsal (20^{mm}) about equal to the diameter of the eye. The longest rays are not so long as the barbel. It contains at least 110 rays.

Anal inserted under the interspace between the two dorsals, its height equal to $\frac{1}{4}$ the length of the head. It contains at least 110 rays.

Pectoral inserted in advance of the origin of the first dorsal, its length (33^{mm}) half that of the head. Its tip extends to the vertical from the fifth anal ray and to about the seventeenth scale of the lateral line.

The ventral originates under the second spine of the dorsal, its outer ray is somewhat produced, extending slightly beyond the origin of the anal. The naked space on the breast is longer than broad, half as long as the eye. The distance of the vent from the origin of the ventral, equals the length of the eye.

Color, silvery gray, with yellowish or brownish tints.

Number.	Station.	North latitude.	West longitude.	Fathoms.	Specimens.
		° ′ ″	° ′ ″		
37333	2377	29 07 30	88 08 00	210	1 (type).
	2377	29 07 30	88 08 00	210	7
	2143	9 30 45	76 25 30	155	1
	2400	28 41 00	86 07 00	169	3
	2401	28 38 30	85 52 30	142	5

Macrurus occa, n. s.

The typical specimen, number 37334, is 450 millimeters long; its tail is injured.

A species with an exceedingly elongate snout, nearly twice as long as the eye, with a black flap between the nostrils; with the angle of the mouth nearly reaching to the vertical from the posterior margin of the orbit; the head contained $3\frac{1}{2}$ times in total length and equaling twice the greatest height of body. The ridge of the head is very strong and continuous from the snout to the angle of the preopercle; strong supraocular and occipital ridges also present.

Eye nearly round, its horizontal diameter $\frac{1}{4}$ length of the head and equal to interorbital space.

The ventral originates under the middle of the first dorsal, and extends to the 4th ray of the anal. The distance from ventral origin to vent is contained $3\frac{1}{2}$ times in length of head.

The second spine of the dorsal is weak and smooth, its length equal to postorbital part of head, its base slightly less than distance between first and second dorsals.

Squamation excessively rough, each scale bearing about 5 large spines besides many smaller ones, the median spine of the large series being much the largest. Five rows of scales between origin of dorsal and lateral line, 19 from vent forward to lateral line and 12 backward.

Barbel $\frac{1}{4}$ as long as snout.

M. atronasus appears to be a near relation of *M. trachyrhynchus*, which has not yet been adequately described.

The single example known is from station 2396, north latitude 28° 34′, west longitude 86° 48′, 335 fathoms.

Coryphænoides sulcatus, n. s.

The type of this species, 37335, is an individual 238 millimeters long, taken at Albatross station 2394, with a large specimen (about 350^{mm}) badly mutliated, from Blake station LXXIII, off Martinique, 472 fathoms, as a collateral type.

The body is elongate, rapidly contracted behind the abdomen, the tail long and whip-like; greatest height of body (25^{mm}) $9\frac{1}{2}$ times in total length.

Scales moderate, strongly armed, each with 8-10 spinelets irregularly placed, the spinelets less numerous in the young, which feel bristly to the touch, separated by wide deep furrows (hence the specific name). More than 175 in the lateral line. Between origin of dorsal fin and lateral line 7; counting from the origin of the lateral line the number of scales in a distance equal to length of head is 33. Between the anal and vent 21-22 (counting forward from vent, 16 counting backward).

Armature of head similar to that of body, but the scales upon the snout, cheeks, and chin have very feeble spines.

Length of head (32^{mm}) $7\frac{1}{2}$ times in total length.

Interorbital area nearly flat, its length (10^{mm}) equal to diameter of eye, and a little less than one-third length of head. Postorbital portion of head (15^{mm}) $1\frac{1}{2}$ times as long as diameter of eye. Eye circular, in larger individual its diameter less than width of interorbital space, $3\frac{2}{3}$ times in length of head. Snout short, obtuse, scarcely overhanging the mouth, its length (7^{mm}) $4\frac{1}{2}$ times in that of head; in the larger individual it is $4\frac{1}{3}$ times in length of head.

Nostrils somewhat above level of middle of eye, the anterior one nearly upon the dorsal outline.

Teeth in upper jaw in two series, the outer series somewhat enlarged; in lower jaw in a single series.

The end of the maxilla reaches to the vertical through the hind margin of pupil in the large specimen, to that through the front margin of the same in the type. Length of upper jaw, including maxilla (11^{mm}), about 3 times in length of head. Length of mandible (13^{mm}) equal to one-half the height of the body. Barbel (4^{mm}) $2\frac{1}{2}$ times in diameter of eye; in the large specimen it is half as long as the eye.

Gill-rakers rudimentary; the attachment of the membrane to the first arch is very extensive. Pseudobranchiæ absent.

First dorsal comparatively low, composed of 2 spines, the first rudimentary, the second elongate, smooth, and 8–9 rays. Its insertion is immediately over that of the pectoral; its distance from the snout (36^{mm}) equals $1\frac{1}{8}$ times the length of the head; its length of base (7^{mm}) equal to length of snout. Its longest spine, when laid backward, reaches beyond origin of second dorsal, its length (15^{mm}) one-half to two thirds that of the head.

Second dorsal very low; its distance from first dorsal equal to one-third length of head; in the type about one-fourth.

Anal much higher than second dorsal, yet very low, its longest ray equal in length to diameter of eye; its distance from snout (51^{mm}) $4\frac{2}{3}$ times in total length, its origin being nearly under that of the second dorsal.

Pectoral inserted under origin of first dorsal, its length about $\frac{1}{2}$ that of head.

Ventral inserted behind the vertical from the end of the base of the first dorsal in the type. In the mutilated larger specimen it appears to be under the posterior ray of the first dorsal. The ventral extends to the origin of the anal, its length (10^{mm}) equaling diameter of eye; in large specimen $1\frac{1}{4}$ diameter of eye. Vent about midway between origin of ventrals and anal.

Radial formula: D. II, 8–9; A. 120; V. 7; P. 13.

In a distance equal to length of head 32 rays were counted in the dorsal fin; in the anal fin 22.

Color brown, abdomen and lower part of head in young blackish.

Malacocephalus occidentalis, n. s.

Small specimens, 37336, in imperfect condition were obtained from Albatross Station 2310, north latitude 35° 44′, west longitude 74° 51′ (length 154^{mm} and 203^{mm}), at a depth of 132 fathoms, and from Blake station LXXXIII, off Granada, at a depth of 164 fathoms (length 141^{mm}). They correspond in the main with Günther's full description of *Malacocephalus lævis*, but differ in the position of the vent, the ventrals, and the anal fin; the latter commencing at a distance behind the vent equal to the length of the snout, its distance from the origin of the ventrals being less than the distance from the origin of the anal, which is distinctly behind the vertical through the posterior end of the first dorsal. The ventrals originate under the middle of the first dorsal, and the pectorals under its origin. The ventral extends to, or slightly beyond, the anal origin. The pectoral is as long as the head without its postorbital part. The diameter of the eye is contained $2\frac{1}{4}$ times in the length of the head. The barbel is slightly longer than the eye. The snout is $\frac{1}{4}$ as long as the head and equal to the interorbital space.

It differs also in the serrature of the second dorsal spine, and its length, which is nearly equal to, if not longer than, the head. In our mutilated specimens the first branched ray is nearly as long as the head.

The gill-rakers are rudimentary, there being 11 below the angle of the arch.

Bathygadus cavernosus, n. s.

The type, number 37337, is a young specimen, 162 millimeters long, obtained by the Albatross at station 2398, north latitude 28° 45′, west longitude 86° 26′, at a depth of 227 fathoms.

The body is stoutish, its greatest height (23^{mm}) contained 7 times in total length.

The scales are moderate, deciduous, cycloid, with no visible armature, about 8 rows under the base of the first dorsal.

Length of head (28^{mm}) about 6 in total length. The bones of the head are very soft and cavernous, in many places without muscular covering, spongy. Interorbital area doubly concave with a spinous medial ridge; its greatest width (10^{mm}) about $2\frac{4}{5}$ in the length of the head.

Postorbital portion of head (13^{mm}) about half its length, $1\frac{1}{3}$ as long as eye, which is circular, its diameter (10^{mm}) contained $2\frac{4}{5}$ times in the length of the head.

Snout broad, very obtuse, its width at nostril nearly equal to interorbital width, its length (6^{mm}) $4\frac{2}{3}$ times in that of the head. Nostrils normal.

Teeth in both jaws in villiform bands, very small; a naked space at the symphysis of the intermaxillary; vomer and palatine toothless. Gill-rakers very short, minute and rather numerous; about 18 below the angle of the anterior arch. Pseudobranchiæ absent. Barbel two-fifths as long as the eye.

First dorsal composed of 2 spines, the first of which is minute, inserted at a distance from the snout (28^{mm}) equal to the length of the head; the second as long as the head without the snout, and 10 branched rays; its base (10^{mm}) equal to diameter of eye. Second dorsal almost rudimentary, its rays remarkably short, about 133 in number; its distance from the first dorsal half the length of head.

Anal much higher than second dorsal, its distance from the snout (46^{mm}) contained about $3\frac{1}{2}$ times in the total length. About 27 rays in a space equal to length of head. Anterior rays longest, in length about three-fourths of the diameter of the eye.

Pectoral inserted under the first branched ray of the first dorsal, its length (20^{mm}) equal to twice that of the eye and about two-thirds length of head.

Ventral slightly behind the pectoral, its first ray filamentous, reaching to the base of the tenth anal ray; it consists of 11 rays.

Color gray, with silvery tints on sides; the abdomen and lips dark.

Bathygadus macrops, n. s.

The type, number 37339, was taken at station 2396, north latitude 28° 34′, west longitude 86° 48′, at a depth of 335 fathoms, by the steamer Albatross. Its length is 305 millimeters.

The body is somewhat compressed; its greatest height (46^{mm}) is contained $6\frac{1}{2}$ times in the total length.

Scales small, deciduous,* as nearly as can be counted 25 rows in an oblique line from the vent to the dorsal fin, 24 from the upper angle of operculum to the vertical through the origin of the anal.

Length of head (55^{mm}) contained $5\frac{1}{4}$ times in total length. Interorbital area nearly flat, its width contained 4 times in length of head. Postorbital part of head (26^{mm}) somewhat longer than diameter of eye, which is nearly round, its length (20^{mm}) contained $2\frac{3}{4}$ times in length of head. Snout broad, obtuse, its length (11^{mm}) contained 5 times in that of the head. Nostrils close to the eye, the posterior nearly twice as large as the anterior one. The maxilla extends to the vertical through posterior margin of orbit, its length (30^{mm}) equal to that of head without its postorbital portion. Length of mandible (34^{mm}) equals 3 times that of the snout. Intermaxillaries and mandible provided with narrow bands of villiform teeth, those in the mandible much shorter.

A minute barbel, about one-third as long as snout. Vomer and palate toothless.

Gill-rakers lanceolate, elongate, 26 on first arch, 7 above the angle, the longest one-seventh as long as the head. Pseudobranchiæ absent. The first dorsal consists of 2 short spines and 8 branched rays, its distance from snout (62^{mm}) contained nearly 5 times in the total length. The second or longest ray in the typical specimen twice the length of snout. The second dorsal, which contains about 125 rays, is almost continuous with the first, its anterior rays the longest, about 4 times in length of head.

The anal is inserted under the fourteenth ray of second dorsal. Its rays are all very short. In a distance equal to length of head, counting back from insertion, there are 33 rays.

The pectoral is inserted under the first branched ray of the first dorsal; its length in the most nearly perfect specimens equals the length of the head without the snout.

The ventral origin very slightly behind origin of pectoral under the third branched ray of the dorsal, reaching nearly to the vent when laid back. Its length (35^{mm}) equaling three times that of snout. Rays 8. Branchiostegals 7.

Color yellowish gray, lighter below.

Bathygadus longifilis, n. s.

The types, No. 37338, are 2 specimens taken by the Albatross at station 2392, north latitude 28° 47′ 30″, west longitude 87° 27′ 00″, depth 724 fathoms, 225 and 233 millimeters in length, the measurements taken from the largest.

The body is more compressed than in *B. macrops*. Its greatest height (31^{mm}) contained $7\frac{1}{2}$ times in total length.

* Not one of our specimens has scales, so their character cannot be made out, nor can the lateral line be described.

Scales small, cycloid, deciduous, about 142 in the lateral line, about 25 rows from the vent upward and forward to the dorsal fin.

Length of head (40^{mm}) contained about $5\frac{3}{4}$ times in total length. Interorbital area flattened, its greatest width contained about $3\frac{2}{3}$ times in the total length of the head. Postorbital portion of head (20^{mm}) twice as long as the eye, which is oval, its long diameter (10^{mm}) contained four times in the length of the head, and equal to length of snout.

Snout and nostrils normal.

The maxilla reaches somewhat beyond the posterior margin of orbit, its length (21^{mm}) twice in distance from snout to origin of first dorsal. Length of mandible (26^{mm}) is contained $2\frac{1}{2}$ times in length of the snout. Barbel slender, long, its length (15^{mm}) equal to $1\frac{1}{2}$ times orbital diameter.

Teeth in narrow villiform bands in both jaws, none on vomer or palatine bones. Gill-rakers very long and slender, numerous, 35 on first arch (7 above angle), the largest (7^{mm}) contained nearly six times in the length of the head.

Pseudobranchiæ absent.

First dorsal of 2 stout spines, the first minute, the second elongate, and 8–9 branched rays. Its distance from snout (42^{mm}) $5\frac{1}{2}$ in total. The second or longest simple ray (77^{mm}) is nearly eight times the length of the snout, and reaches to or beyond the thirtieth ray of the second dorsal. The second dorsal contains about 140 rays; it is almost continuous with the first, its anterior rays longest and not diminishing rapidly in size toward the tail.

The anal is inserted under the ninth ray of the second dorsal, its rays much shorter than those in the dorsal, and situated about the same distance apart.

The pectorals are inserted under the anterior portion of the first dorsal, the first ray much produced, extending more than half-way from its insertion to the tip of the tail. Rays 13.

The ventral origin is slightly behind the origin of the pectoral, under the third branched ray of the dorsal, its first ray much enlarged, extending more than half-way from its insertion to tip of caudal. Its length (100^{mm}) is contained $2\frac{1}{3}$ times in the total length. Rays 8. Branchiostegals 7.

Color yellowish-gray, abdomen bluish.

Neobythites, new genus, *Brotulidæ*.

Body brotuliform, much compressed, resembling *Bythites* in general appearance. The head is well covered with scales. Two weak spines at angle of preoperculum and a stronger spine at angle of operculum. The mouth large. The snout is moderate, rounded, projecting very slightly beyond the mouth. The jaws are nearly equal in front, the lower jaw slightly included.

The teeth villiform, in narrow bands in both jaws and on the palatines. Vomerine patch subcircular. Barbel none.

The gill-openings are wide, the membranes deeply cleft and not

attached to the isthmus. Gills 4. Gill-laminæ well developed. Gill-rakers slender, rather short, moderately numerous. Pseudobranchiæ absent. Branchiostegals 8.

The caudal fin is few rayed, pointed, not well differentiated from the vertical fins.

The dorsal and anal fins are well developed, the anterior rays the longest; the outline is continuous to the tip of the caudal. Pectorals broad, of moderate length, normal in form, sessile.

Each ventral a single ray, placed close to the humeral symphysis.

The scales are small. Lateral line incomplete, being obsolete posteriorly.

Neobythites Gilli, n. s.

The type, No. 37340, is from Albatross station 2402, north latitude 28° 36′, west longitude 85° 33′, depth 111 fathoms.

Description: Body compressed, its height (17^{mm}) contained $4\frac{2}{3}$ times in total length and less than length of head. Interorbital area convex, its width (5^{mm}) equal to diameter of circular eye, $3\frac{2}{3}$ in length of head, and $1\frac{1}{2}$ in length of snout.

The length of the head (18^{mm}) is contained $4\frac{1}{2}$ times in that of body. Mouth large, the maxilla extending considerably behind the vertical through posterior margin of eye, expanded posteriorly; the mandible still longer, its length (11^{mm}) about $2\frac{1}{3}$ times in the height of the body. Teeth in villiform bands in the jaws and on the palatines. Vomerine patch broadly V-shaped, with a circular bunch at the angle.

Gill-rakers moderately long and slender, somewhat numerous, the longest about two-thirds diameter of eye; eleven developed and 3 rudiments below the angle. Pseudobranchiæ absent. Gill-opening wide, the membrane deeply cleft, free from the isthmus behind. A single long flat spine attached to the posterior portion of the operculum, high up, extending back along to its edge.

Nostrils small, the anterior one in a very short tube, almost upon the tip of the snout; posterior nostril slightly larger, not tubular, immediately in front of middle of eye.

No apparent cirri.

Scales moderate, in 88 vertical rows, 7 rows between dorsal origin and lateral line, which becomes obsolete in its posterior half; 16 to 17 from vent forward to lateral line.

Dorsal origin behind ventral and pectoral. Its distance from snout (21^{mm}) contained 4 times in total length. Its rays moderately long.

Anal origin under the eighteenth dorsal ray. Its distance from snout (34^{mm}) contained $2\frac{1}{3}$ times in body length. Rays rather slenderer than those in the dorsal.

The caudal consists of 6 or 7 rays; its length (9^{mm}) contained 9 times in total length.

Pectoral origin well forward; its base somewhat concealed by the

flap of the operculum; its length (13^{mm}) about equal to two-thirds that of head.

Ventral, a bifid ray, inserted slightly in advance of the base of the pectoral and not far from humeral symphysis. It reaches nearly to the vent. Its length (15^{mm}) nearly equal to height of body.

Distance from origin of ventral to vent slightly greater than height of body.

Color light yellow, with silvery reflections, with clouding of brown above lateral line and numerous black chromatophores.

A series of irregular brown blotches above the lateral line, with two much darker, extending up on the dorsal fin, the largest about midway from the head to the tail.

Porogadus, new genus, *Brotulidæ*.

Body brotuliform, much compressed. Head with numerous spines on interorbital space, two pairs on the shoulders, one at angle of operculum, and a double series on angle of preoperculum. Head with numerous mucous pores, as in *Bathyonus*. Mouth large. Snout moderate, not projecting much beyond upper jaw.

Jaws nearly equal in front. Teeth in villiform bands in jaws and on vomer and palatines. Barbel none.

Gill-openings wide, membranes narrowly united, not attached to the isthmus. Gills 4. Gill-laminæ short. Gill-rakers moderate, numerous. Pseudobranchiæ absent. Caudal fin of few rays, on a very narrow base, not prolonged, scarcely differentiated from the vertical fins. Dorsal and anal fins well developed. Pectorals simple, moderate. Each ventral a single bifid ray, close to the humeral symphysis. Branchiostegals 8. Scales small. Lateral line apparently developed only on anterior part of body, close to dorsal fin. Three series of pores, one close to ventral outline, one median, and another along base of dorsal.

Porogadus miles, n. s.

The type (No. 35625, U. S. N. M.) is 153 millimeters in length; it is from Albatross station 2230, north latitude 38° 27′, west longitude 73° 02′, at a depth of 1,168 fathoms.

Description: Body much compressed, elongate, tapering to a very slender tail, its height (15^{mm}) nearly 10 times in total length.

Head long, moderately compressed, subconical; the profile gradually ascending in nearly a straight line from the tip of the snout to the origin of the dorsal. Its length (23^{mm}) $6\frac{1}{2}$ times in that of body. Interorbital space slightly convex, spiny, its width (5^{mm}) $4\frac{3}{5}$ times in length of head, and slightly greater than diameter of eye.

Eye oval, its greatest diameter (4^{mm}) $5\frac{3}{4}$ times in length of head. Opercles and head generally covered with numerous and strong spines, as described in the generic diagnosis.

Mouth very large and wide. The maxilla extending far behind the eye and much expanded at its tip; its length (13^{mm}) more than half

that of head. Length of mandible (15^{mm}) equal to greatest height of body. Jaws, vomer, and palatines with narrow bands of villiform teeth, none of which are enlarged. Gill-rakers, 15 on anterior arch below the angle, 3 rudimentary ones above.

The anterior pair of nostrils are nearly on top of the snout, and somewhat nearer to its tip than to the eye, separated by a very narrow space, and placed immediately in front of the middle of the eye. Behind each posterior nostril is a strong spine projecting outward and backward. Pores of the head arranged much as in *Bathyonus.*

Scales minute. Lateral line not clearly to be made out. Three rows of minute pores on each side—dorsal, median, and ventral, beginning near the head and extending well toward the extremity of the tail.

Dorsal origin slightly behind vertical through pectoral base; its distance from the snout (25^{mm}) nearly 6 times in length of body. Its rays are moderately long, the longest about as long as the snout (one-fourth of head), and very numerous.

Anal origin in vertical from twenty-second or twenty-third dorsal ray; its distance from the snout (44^{mm}) $3\frac{1}{3}$ times in length of body. Its rays about as long as those of the dorsal.

Pectoral imperfect, its length in the type equals one-half that of the head.

Ventral a bifid filament, placed close to the humeral symphysis, well in advance of the pectoral; its length (15^{mm}) equal to height of body. Distance from origin of ventrals to vent (22^{mm}) nearly equal to length of head. The ventral does not reach to the vent by a distance equal to length of snout.

Color, blackish brown.

Bathyonus, new generic name.

=*Bathynectes*, Gthr., preoccupied in crustacea.

Bathyonus is closely related to *Dicrolene*, which, however, has a form much less elongate, the lower pectoral rays differentiated from the rest of the fin, the ventral always bifid, and strong spines upon both operculum and preoperculum.

Bathyonus catena, n. s.

The types (No. 37341) are from Albatross station 2379, north latitude 28° 00′ 15″, west longitude 87° 42′, 1,467 fathoms. The length of the longest is 237 millimeters, of the other 227 millimeters.

Description: Body very elongate, much compressed, and tapering into a slender, whip-like tail. Its height (19^{mm}) is contained $1\frac{1}{2}$ times in length of head and $12\frac{1}{2}$ times in that of the body.

Head stoutish, not much compressed, higher than body, its length (27^{mm}) contained $8\frac{2}{3}$ times in that of body. Interorbital area somewhat convex, its width (measured upon the bone) equal to the diameter of the eye and about equal to that of the snout, and contained 5 times in the length of head.

The maxilla extends beyond the vertical through the posterior margin of orbit, its length equal to that of postorbital part of head. Mandible two-thirds as long as head and equal in length to height of body. Jaws, vomer, and palate with bands of villiform teeth; the vomerine band **V**-shaped.

Branchiostegals 8. Pseudobranchiæ absent.

Gill-rakers long and numerous, the longest slightly exceeding in length the diameter of eye; 15 developed below the angle of the first arch, besides several rudiments.

Nostrils in front of the middle of the eye, separated by a slight interspace, the anterior nearer to its mate than to the tip of the snout.

The muciferous channel upon the infraorbital ring shows in its course several wide subcircular sinuses, closely approximated; a similar row upon the posterior edge of the preoperculum and continued forward upon the under surface of the mandible; the vertex also has a semicircle of similar sinuses. To the chain-like appearance of these rows of ducts the specific name has reference.

The dorsal origin is slightly behind that of the pectoral, its distance from the tip of the snout (32^{mm}) about $7\frac{1}{3}$ in total; rays well developed; in the anterior third of the fin, in a space equal to the length of the head, were counted 20 rays, the longest of which is two-fifths as long as the head.

The anal origin is under the twenty-first dorsal ray; its rays are shorter than those of the dorsal. The pectoral extends to the vertical from the eighteenth ray of the dorsal. It is four-fifths as long as the head.

The ventral is composed of a simple filament, its origin slightly in advance of the vertical through the pectoral origin, its length two-thirds that of the head. It does not reach near to the vent, the distance of which from the origin of the ventrals (30^{mm}) is slightly greater than the length of the head.

Color, brownish yellow. Head and abdomen blackish.

Bathyonus laticeps (Gthr.), from 2,500 fathoms in the mid-Atlantic, has smaller eyes, broader head (if the measurements of the interorbital space as given by Günther afford a correct criterion), and a more filamentous caudal prolongation.

B. compressus (Gthr.), from mid-Atlantic, 1,075–2,500 fathoms, and from stations southeast of New Guinea, is, as its name indicates, much more compressed, with swollen snout, and has the arms of the vomerine **V** curved.

B. gracilis (Gthr.), to which *B. catena* is probably most closely allied, is from south of New Guinea, 1,400 fathoms, and, from the description, would appear to be a long-bodied form.

Bathyonus pectoralis, n. s.

The type (37342, U. S. N. M.) was taken at Albatross station 2380, north latitude 28° 02′ 30″, west longitude 87° 43′ 45″, 1,430 fathoms. It

is 183 millimeters long to caudal base, 215 with caudal. Another specimen is numbered Blake, XCV, off Dominica, 330 fathoms (juv.); this is 70 millimeters long.

Description: Body moderately elongate, much compressed, the tail much shorter and more robust than in *B. catena.* Its height (26^{mm}) equals $1\frac{1}{3}$ times the length of the head and one-seventh that of the body.

Head stoutish, not much compressed, lower than body, its length (34^{mm}) contained $5\frac{1}{3}$ times in the body length. Snout compressed, broad at its tip, its length (6^{mm}) exceeding the diameter of the circular eye (5^{mm}). Interorbital area slightly convex, its width (11^{mm}) slightly exceeding twice the diameter of the eye, 3 times in length of head.

Maxilla extending far behind the eye, its length (19^{mm}) less than that of preorbital portion of head. Mandible as long as postorbital portion of head (22^{mm}). Jaws, vomer and palatine, with narrow bands of villiform teeth, normally arranged. Branchiostegals 8. Gill-lamellæ very short. Gill-rakers long and numerous, 18 on first arch below the angle, 5 above, 4 of which are rudimentary. Pseudobranchiæ present, but very rudimentary.

Anterior nostrils on the top of the snout and near the median line of the head, near its tip, separated by a space about equal to the diameter of the eye. Posterior nostrils in front of the eye.

Muciferous pores large, arranged much as in *B. catena.*

Dorsal origin in the same vertical with that of the pectorals, its distance from the tip of the snout (38^{mm}) contained 5 times in total and equaling twice the length of the maxilla. Rays well developed in the anterior third, the longest two-thirds of head's length.

The anal origin is under the twentieth dorsal ray; its rays are nearly as long as those of the dorsal. The pectoral has its penultimate ray produced, extending to the thirteenth ray of the anal; it is nearly twice as long as the head. Ventrals bifid, originating in advance of the vertical through the pectorals. Distance of the ventral origin from tip of snout (26^{mm}) equaling length of ventral and about three-fourths as long as the head. Distance of origin of ventral from vent (42^{mm}) considerably greater than length of head. Distance from tip of ventral to vent equal to half the length of the head.

Numbers of scales in transverse series from vent to dorsal about 23; from the upper angle of the gill-opening to the vertical through origin of anal, 32.

Color, brownish yellow. Head and abdomen blackish.

D. 93; A. 73; P. 17; V. 2.

This species seems closely related to *Bathyonus laticeps* (Gthr.), but differs in several important particulars, notably the prolongation of the pectoral ray and the form of the tail.

REPORT UPON THE ECHINI COLLECTED BY THE U. S. FISH COMMISSION STEAMER ALBATROSS IN THE GULF OF MEXICO FROM JANUARY TO MARCH, 1885.

By RICHARD RATHBUN.

NOTICE OF THE CRUISE OF 1885.

The U. S. Fish Commission steamer Albatross left Norfolk, Va., January, 1885, on a second winter's cruise to the Gulf of Mexico, this time solely in the interest of the Fish Commission, and for the purpose of exploring the fishing grounds lying off the southern coast of the United States. These grounds had never been previously investigated, and the only information we possessed respecting their character and extent had been obtained from the fishermen. On the trip to Key West the Albatross spent one day fishing with trawl lines off South Carolina, in depths of about 80 to 100 fathoms, but stormy weather interfering with the continuation of the work in that latitude, it was abandoned for the time being.

At Key West the important fishing interests centering in that place were studied with great care, and thence the Albatross proceeded to Havana, Cuba, spending about four days on the famous Pentacrinus ground located off Havana light, a portion of the party at the same time making a brief examination of the fisheries and fishing craft of the region. The next localities visited were the island of Cozumel and Campeche Bank, off Yucatan, where seines and hand-lines were employed in making collections of fishes with a view to obtaining information respecting the migrations and spawning habits of certain species of fishes that also inhabit our own coast. The remainder of the cruise, excepting about two weeks spent at New Orleans, was devoted to exploring the fishing grounds of the northeastern part of the Gulf of Mexico, from the mouth of the Mississippi River to Cedar Keys, Fla., and from the latter place to the Dry Tortugas. The principal fishery of this region is for the red snapper, and the most satisfactory results regarding the distribution and habits of that species were obtained between Tampa Bay and the Dry Tortugas, in depths of 25 to 28 fathoms. The shore fisheries at the mouth of Manatee River, Florida, were also studied, and the existence of a reported bank outside of the 100-fathom line off Mobile was disproved.

The investigations were all carried on with extreme thoroughness, and included many lines of temperature observations and dredgings across the fishing grounds to ascertain their chief characteristics. In this manner many valuable collections of fishes and invertebrates were obtained, and they are now safely stored at the National Museum, where they are being studied. One hundred and ten dredging stations (serial

numbers 2311 to 2420, inclusive) were made, in depths of 21 to 1,467 fathoms, the deepest series, ranging from 730 to 1,467 fathoms, being located directly south of Mobile. On the return trip several lines of serial temperatures were carried out from the capes of Virginia across the area in which the schools of mackerel and menhaden first appear at the beginning of their spring migrations toward the north; and it is believed that a continuance of these observations through several years will afford some clue to the changes observed in the movements of these fish from year to year. An account of the practical results obtained on this cruise will soon be published.

Lieut.-Commander Z. L. Tanner, U. S. N., was in command of the expedition, with Capt. J. W. Collins in charge of the practical fishery investigations, and Mr. James E. Benedict chief naturalist, assisted by Mr. Willard Nye, jr., and Mr. Thomas Lee. Dr. T. H. Bean, curator of the department of fishes in the National Museum, also accompanied the steamer during the first half of the cruise, and Mr. Silas Stearns, of Pensacola, Fla., made two trips to the red-snapper grounds.

Of the group of Echini, or sea urchins, 31 species were collected in suitable condition for determination, being 8 more than were obtained in the same region the previous winter. These represent 78 dredging stations, with depths of 21 to 1,330 fathoms, only one species having been obtained in shore collecting, viz., at the island of Cozumel. Seventeen species were additional to those collected in 1884, and 9 of the species collected in 1884 were not obtained in 1885. The total number of species obtained on these two cruises was 40. I am indebted to Mr. Alexander Agassiz for assistance in making some of the identifications. The numbers in parentheses refer to the Radiate catalogue of the U. S. National Museum.

List of the stations at which Echini were collected in 1885.

OFF SOUTH CAROLINA.

Station No.	Date.	Locality. N. Lat.	Locality. W. Long.	Depth.	Nature of bottom.	Temperature at bottom.
	1885.	° ′ ″	° ′ ″			F.
2312	Jan. 5	32 54 00	77 53 30	88	crs. S., bk. sp	57.8
2313	Jan. 5	32 53 00	77 53 00	99	crs. S., bk. sp., brk. Sh.	57.2

OFF KEY WEST, FLA.

2315	Jan. 15	24 26 00	81 48 15	37	Cr	
2316	Jan. 15	24 25 30	81 47 45	50		74
2317	Jan. 15	24 25 45	81 46 45	45	Cr	75
2318	Jan. 15	24 25 45	81 46 00	45	Cr	75

List of the stations at which Echini were collected in 1885—Continued.

OFF HAVANA, CUBA.

Station No.	Date.	Locality. N. Lat.			Locality. W. Long.			Depth.	Nature of bottom.	Temperature at bottom.
	1885.	°	′	″	°	′	″			F.
2319	Jan. 17	23	10	37	82	20	06	143	gy. Cr	......
2320	Jan. 17	23	10	39	82	18	48	130	fne. Cr	......
2321	Jan. 17	23	10	54	82	18	00	230	fne. gy. S	......
2322	Jan. 17	23	10	54	82	17	45	115	Cr	......
2323	Jan. 17	23	10	51	82	19	03	163	wh. Cr	......
2324	Jan. 17	23	10	25	82	20	24	33	Cr	79.1
2325	Jan. 17	23	10	48	82	19	54	170	Cr	......
2326	Jan. 17	23	11	45	82	18	54	194	Cr	62
2327	Jan. 17	23	11	45	82	17	54	182	fne. bn. S	......
2330	Jan. 17	23	10	48	82	19	15	121	fne. gy. Cr	......
2331	Jan. 17	23	10	31	82	19	55	114	Cr	......
2333	Jan. 19	23	10	36	82	19	12	169	fne. wh. Cr	......
2334	Jan. 19	23	10	42	82	18	24	67	wh. Cr	......
2335	Jan. 19	23	10	39	82	20	21	204	....	......
2336	Jan. 19	23	10	48	82	18	52	157	Cr	......
2337	Jan. 19	23	10	39	82	20	21	199	Cr	......
2338	Jan. 19	23	10	40	82	20	15	189	Cr	......
2341	Jan. 19	23	11	00	82	19	06	143	Cr	......
2342	Jan. 19	23	10	39	82	20	21	201	Cr	......
2343	Jan. 19	23	11	35	82	19	25	279	fne. Cr	......
2345	Jan. 20	23	10	40	82	20	15	184	fne. gy. wh. Cr	......
2346	Jan. 20	23	10	39	82	20	21	200	Cr	......
2347	Jan. 20	23	10	39	82	20	21	216	Cr	......
2348	Jan. 20	23	10	39	82	20	21	211	Cr	......
2349	Jan. 20	23	10	40	82	20	15	182	Cr	......
2350	Jan. 20	23	10	39	82	20	21	213	Cr	......

OFF WEST COAST OF CUBA.

2351	Jan. 21	22	41	00	84	16	30	426	....	......
2352	Jan. 21	22	35	00	84	23	00	463	wh. Cr	45

OFF ARROWSMITH BANK, YUCATAN.

2354	Jan. 22	20	59	30	86	23	45	130	Cr	......

OFF COZUMEL ISLAND, YUCATAN.

2357	Jan. 29	20	19	00	87	03	10	178	wh. Cr	......
2358	Jan. 29	20	19	00	87	03	30	222	fne. wh. Cr	......
2359	Jan. 29	20	19	10	87	03	30	231	wh. Cr	50.8

OFF CAPE CATOCHE, YUCATAN.

2360	Jan. 30	22	08	30	86	49	00	26	wh. Cr	......
2362	Jan. 30	22	08	30	86	53	30	25	Cr. S	......
2363	Jan. 30	22	07	30	87	06	00	21	Cr	......
2365	Jan. 30	22	18	00	87	04	00	24	Cr	......

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List of the stations at which Echini were collected in 1885—Continued.

BETWEEN LOUISIANA AND CEDAR KEYS, FLA.

Station No.	Date.	Locality. N. Lat.	Locality. W. Long.	Depth.	Nature of bottom.	Temperature at bottom.
	1885.	° ′ ″	° ′ ″			F.
2369	Feb. 7	29 16 30	85 32 00	26	crs. gy. S. brk. Sh	......
2370	Feb. 7	29 18 15	85 32 00	25	crs. gy. S. brk. Sh	......
2371	Feb. 7	29 17 00	85 30 45	26	gy. S. brk. Sh	65.8
2372	Feb. 7	29 15 30	85 29 30	27	G	......
2373	Feb. 7	29 14 00	85 29 15	25	Cr	......
2374	Feb. 7	29 11 30	85 29 00	26	S. G. brk. Sh	......
2375	Feb. 7	29 10 00	85 31 00	30	S. bk. sp. brk. Sh	......
2376	Feb. 11	29 03 15	88 16 00	324	gy. M	46.5
2378	Feb. 11	29 14 30	88 09 30	68	......do	......
2381	Mar. 2	28 05 00	87 56 15	1,330	lt. bn. M	......
2383	Mar. 3	28 32 00	88 06 00	1,181	br. gn. M	39.8
2384	Mar. 3	28 45 00	88 15 30	940	br. gy. M	39.6
2385	Mar. 3	28 51 00	88 18 00	730	gy. M	40.1
2388	Mar. 4	29 24 30	88 01 00	35	yl. S. bk. sp	......
2392	Mar. 13	28 47 30	87 27 00	724	br. gy. M	40.7
2393	Mar. 13	28 43 00	87 14 30	525	lt. gy. M	41.1
2395	Mar. 13	28 36 15	86 50 00	347	gy. M	44.1
2400	Mar. 14	28 41 00	86 07 00	169	......do	......
2401	Mar. 14	28 38 30	85 52 30	142	gn. M. brk. Sh	......
2402	Mar. 14	28 36 00	85 33 30	111	gy. M	......
2403	Mar. 15	28 42 30	85 29 00	88	......do	......
2404	Mar. 15	28 44 00	85 16 00	60	gy. S	......
2405	Mar. 15	28 45 00	85 02 00	30	gy. S., brk. Cr	......
2406	Mar. 15	28 46 00	84 49 00	26	crs. S. Cr	......
2407	Mar. 15	28 47 30	84 37 00	24	Cr. brk. Sh	......
2408	Mar. 16	28 28 00	84 25 00	21	Cr	......

BETWEEN TAMPA BAY AND DRY TORTUGAS, FLA.

2409	Mar. 18	27 04 00	83 21 15	26	crs. gy. S. brk. Sh	......
2410	Mar. 18	26 47 30	83 25 15	28	f. wh. S. bk. sp. brk. Sh	......
2411	Mar. 18	26 33 30	83 15 30	27	f. wh. S. bk. sp	......
2412	Mar. 19	26 18 30	83 08 45	27	fne. gy. S. bk. sp. brk. Sh	......
2413	Mar. 19	26 00 00	82 57 30	24	fne. S. bk. sp. brk. Sh	......
2414	Mar. 19	25 04 30	82 59 15	26	f. wh. S. brk. Sh	......

OFF ATLANTIC COAST OF SOUTHERN STATES.

2415	Apr. 1	30 44 00	79 26 00	440	Cr. crs. S. Sh. Foram	45.6
2417	Apr. 2	33 18 30	77 07 00	95	fne. gy. S	65.8
2418	Apr. 2	33 20 00	77 05 00	90	gy. S	65.8
2420	Apr. 5	37 03 20	74 31 40	104	bk. S. M. G	47.7

ACCOUNT OF THE SPECIES OF ECHINI OBTAINED IN 1885.

Cidaris tribuloides Blainv.

A fine series of large specimens was collected at station 2407, 24 fathoms (10734). Small to medium-sized specimens were obtained from the following localities: Station 2315, 37 fathoms (10702); station 2316, 50 fathoms (10703); station 2324, 33 fathoms (10701); station 2342, 201 fathoms; station 2363, 21 fathoms (10700); stations 2372, 2373, 2374,

depth 25–27 fathoms (10697); stations 2405, 2407, 24–30 fathoms (10699); station 2408, 21 fathoms (10696); station 2414, 26 fathoms (10698).

The large specimens from station 2407, above mentioned, have long and rather pointed spines, and in nearly all cases more or less of the spines were overgrown with clusters of small barnacles, bryozoa, worm tubes and shells. Fully one-half the specimens were infested with a species of *Stylifer*, which was generally found boring into the spines, although in one case a single specimen was seen attached to the test, near the base of a spine, having made there a slight burrow. As many as seven spines were sometimes thus affected in a single specimen, but the usual number was from three to five. The spines attacked were mostly toward the upper surface, but not always so, and were generally those of small to medium size.

The borings of the *Stylifer* produce a curious effect. A small, round hole is first formed in the side of the spine near its base, and the irritation apparently induces a continuous deposition of shelly matter, which increases in size until it forms a prominent globular protuberance completely surrounding the spine at the point of irritation. On one side the protuberance is more or less deeply hollowed out, and may contain anywhere from one to eight shells. The spines become stunted in growth, and seldom have more than a small point projecting above the excrescence. The upper part of the protuberance with the tip of the spine may finally break away, leaving the opening to the cavity at the outer end of an abrupt enlargement of the spine. The boring generally takes place at the lower end of the spines, frequently just above the base. In a few instances there are quite regular globular terminations to short spines without much of a cavity, or with none at all, and these have probably been produced by a deposition of shelly matter over the burrows after the *Stylifers* had left them.

The protuberances range in size from a very slight enlargement to twice the diameter of the base of the spine, and are frequently quite grotesque in shape and in the appearance of the concavity, the latter being often so large as to leave but a thin shell inclosing it. There are sometimes two or three openings to one protuberance. The outer surface generally resembles that of the smaller and smoother spines, but is occasionally covered with a coarse granulation. Its color is a rich brown to brownish black. The spines not infested by *Stylifers* are all perfectly normal.

A very small specimen from station 2372 had a single specimen of the same *Stylifer* upon one of the spines close to the abactinal system.

Dorocidaris Bartletti A. Agassiz.

Three fine large specimens were obtained from the following localities: Station 2326, 194 fathoms (10659); station 2331, 114 fathoms (10660); station 2335, 204 fathoms (10661). Young specimens were collected at stations 2327, 2337, depth 182, 199 fathoms (10707); and characteristic spines at the following stations: 2320, 2322, 2324, 2325,

2327, 2330, 2334, 2349, depth 33–182 fathoms (10662). The young specimens collected at station 2138, depth 23 fathoms, 1884 (7479), and referred in the last report to *Cidaris tribuloides*, belong to this species.

The three larger specimens mentioned above came up in excellent condition, with most of the spines intact. The smallest of the three, from station 2335, measured 28 millimeters in diameter; the largest, from station 2326, measured 68 millimeters in diameter; height, 50 millimeters; actinostome, 24 millimeters; apical system, 26 millimeters; length of longest radiole, 78 millimeters; 9–10 primary interambulacral plates. The spines in all of these specimens exhibited every gradation in structure from the nearly smooth variety to those which are strongly spiny, the latter greatly predominating. In one of the specimens the genital plates are in contact at their inner ends, but in the others the ocular plates touch the anal.

Dorocidaris papillata A. Agassiz.

Typical specimens, mostly of small size, were obtained from the following localities: Stations 2319–2322, 2324, 2327, 2336, 2337, 2342, 2345, 2346, 2347, 2348, and 2349, depth 33 to 230 fathoms (10710); station 2323, 163 fathoms (10709); station 2341, 143 fathoms (10708); station 2415, 440 fathoms (10756).

A variety of this species, with slender, strongly serrated spines, described by Mr. Alexander Agassiz in his "Revision of the Echini," pages 256–257, was collected in very large numbers at each of the four following stations: 2316, 2317, 50 fathoms (10051); 2318, 45 fathoms (10052, 10712); 2418, 90 fathoms (10053). A few specimens of the same were also obtained at station 2334, 67 fathoms (10713); 2351, 426 fathoms (10711); 2372, 2373, 25–27 fathoms (10715); 2420, 104 fathoms (10714).

Of this variety the larger specimens measure about 32 millimeters in diameter, and all have long, very slender, tapering spines, equalling in length from one and one-half to three times the diameter of the test, the spines being usually proportionally longer in the smaller specimens. The general color of the test in alcoholic specimens is a pale yellowish, greenish, or buff; the secondary spines have each a broad band of dark pink through the center, which sometimes covers nearly the entire width of the spines. The primary spines in young specimens are generally greenish, and in the larger ones are grayish with a tinge of green; they are frequently banded. The abactinal system is violet or violet brown, the color varying much in intensity, the ocular plates being lighter than the others.

Porocidaris Sharreri A. Agassiz.

Two large specimens were obtained from station 2354, 130 fathoms (10717); and one medium-sized specimen came from each of the three following localities: Station 2345, 184 fathoms (10706); station 2348, 211 fathoms (10705); station 2415, 440 fathoms (10704). Fragments of

spines were dredged at stations 2337, 2338, 2341, 2360, depth 26–199 fathoms (10716).

The two specimens from stations 2345 and 2348 are very similar in appearance and of nearly the same size, the smaller measuring 27 millimeters in diameter. The spines are long, straight, and tapering, and of a pure white to a light pinkish and brownish-white color, with the bases of the delicate brownish-pink described by Mr. Alexander Agassiz. These spines are very finely striated, but appear smooth to the naked eye.

In the larger specimens from station 2354, which are also both of about the same size (the larger measuring 51 millimeters in diameter) the spines are likewise slender, straight, very long, and gradually tapering, being very uniform in their general appearance over most of the two specimens. They are finely fluted, and the still finer striation of the surface is also apparent; the bases are of a rich reddish-brown, much darker than in the smaller specimens. Immediately beyond the base, the shaft becomes of a light green, which gradually changes to a deep pinkish, the two colors blending for a considerable distance. The pink becomes intensified outwardly generally to within about 10 to 20 millimeters of the tip, where it is frequently replaced abruptly by white, especially in the longer spines; sometimes it continues quite to the tip. The pink also produces a slight banding at times on the outer half of the spines. The longer spines measure from 150 to 155 millimeters in length; fully three times the diameter of the test. Some of the spines are slightly enlarged and hollowed out at the tip.

The specimen from station 2415 measures 18 millimeters in diameter.

Salenia Pattersonii A. Agassiz.

Stations 2320, 2321, 2322, 2325, 2327, 2334, 2335, 2337, 2342, 2343, 2345, 2346, 2349, depth 67–279 fathoms (10649). One small specimen from station 2322, 115 fathoms (10652) had three specimens of a *Stylifer* attached to the dorsal surface.

Arbacia punctulata Gray.

All of the specimens obtained were young, the majority being quite small; they were collected at the following localities: Stations 2362, 2363, 2365, depth 21–25 fathoms (10655); stations 2369 to 2373, inclusive, 25–27 fathoms (10656); stations 2405 to 2409, inclusive, 21–30 fathoms (10657); stations 2412, 2413, 24–27 fathoms (10658).

Cœlopleurus floridanus A. Agassiz.

Station 2316, 50 fathoms (10653); stations 2319, 2320, 2322, 2327, 2331, 2334, 2335, 2337, 2342, 2347, 2348, depth 67–216 fathoms (10654).

Diadema setosum Gray.

Station 2333, 169 fathoms (10667), two small specimens; station 2363, 21 fathoms (10059), several large specimens; station 2405, 30 fathoms (10666), one small specimen; station 2138 (1884), 23 fathoms (8433), one very young specimen.

Among the specimens from station 2363 are several with uniformly light colored spines, a sort of yellowish or dirty white color. These light spines are most common on the ventral surface, but sometimes also occur scattered among the dark spines of all parts of the test, producing a very curious effect. In one specimen nearly all the spines are white.

Aspidodiadema antillarum A. Agassiz.

Stations 2385, 2392, 2393, 525–730 fathoms (10663).

Aspidodiadema Jacobyi A. Agassiz.

Stations 2346, 2347, 2350, 200–216 fathoms (10664); station 2359, 231 fathoms (10665).

Asthenosoma hystrix A. Agassiz.

Station 2350, 213 fathoms (10673), two young specimens; station 2358, 222 fathoms (10668), several large specimens, the largest measuring about 200 millimeters in diameter, in alcohol; station 2415, 440 fathoms (10674), small to medium size.

Phormosoma placenta Wyv. Thomson.

Station 2376, 324 fathoms (10670); station 2383, 1181 fathoms (10671), fine series; station 2395, 347 fathoms (10672).

Temnechinus maculatus A. Agassiz.

One living specimen from station 2370, 25 fathoms (10689), and dead specimens from the two following stations: 2372, 27 fathoms (10690); 2405, 30 fathoms (10691).

Trigonocidaris albida A. Agassiz.

Stations 2321, 2327, 2341, 2342, 2343, 2349, depth 143–279 fathoms (10694); stations 2335, 2347, depth 204–216 fathoms (10695); station 2357, 178 fathoms (10692). The following from the Gulf of Mexico collections of 1884 were accidentally included in the last report among the young of the deep water variety of *Toxopneustes variegatus:* Station 2159, 98 fathoms (10693); station 2166, 196 fathoms (8414); station 2167, 201 fathoms (8412).

Toxopneustes variegatus A. Agassiz.

Typical specimens were collected at the following localities: Station 2317, 45 fathoms (10681); station 2362, 25 fathoms (10682); station 2407, 24 fathoms (10683.) These specimens were mostly rather small, and of a pinkish color in alcohol, the test being darker than the spines.

The small deep-water form was obtained at the following localities: Station 2316, 50 fathoms (10687); station 2318, 45 fathoms (10685); stations 2326, 2327, 2335, 2337, 2338, 2342, 2345, 2346, 2349, depth 182–204 fathoms (10686); station 2345, 184 fathoms (10684); station 2347, 216 fathoms (10688).

Hipponoë esculenta A. Agassiz.

Cozumel Island, Yucatan (10669), a single specimen.

Echinocyamus pusillus Van Ph.

One living specimen from station 2352, 463 fathoms (10632); dead specimens from station 2342, 201 fathoms (10631); station 2354, 130 fathoms, and station 2359, 231 fathoms (10623).

Clypeaster Ravenellii A. Agassiz.

Station 2312, 88 fathoms (10055); station 2313, 99 fathoms (10056); station 2317, 45 fathoms (10675); station 2318, 45 fathoms (10643), one young specimen; station 2388, 35 fathoms (10054), a fine large series, containing over one hundred specimens; station 2403, 88 fathoms (10057); station 2404, 60 fathoms (10626, 10644), young and dead fragments; station 2417, 95 fathoms (10058), ten specimens.

The largest specimen collected measured about 135 millimeters in diameter. This species was associated with *Clypeaster subdepressus* at stations 2317 and 2388. The majority of the specimens of *C. subdepressus* obtained were of small to medium size, and rather shorter in proportion to the width than in the more typical specimens; the width was frequently nearly equal to the length. There is, however, no difficulty in distinguishing these two species, even in very young specimens. In *C. Ravenellii* the length and width are always closely the same, excepting in abnormal specimens; the margins, in the interambulacral spaces, excepting in small specimens, are nearly always distinctly, and sometimes quite strongly, incurved, and the entire margin is considerably thickened. In some specimens of *C. subdepressus* the margin becomes slightly thickened, but never so much so as in *C. Ravenellii.*

The entire median portion of the test of *C. Ravenellii*, on the abactinal side, is greatly elevated, with rather abrupt though regularly arched slopes, extending about to the outer ends of the ambulacral petals. The petals are broadly open at their outer ends, and have the poriferous zones nearly parallel along the outer two-thirds of their length. The granulation of the test is much coarser than in *C. subdepressus*, and the principal granules much more widely separated. The coarse granulation of the actinal surface approaches less closely to the ambulacral furrows, which, especially in small specimens, are frequently bordered with broad comparatively smooth areas, reaching to near the margins of the test. The ambulacral furrows are deeper and broader. In nearly all the living specimens which have been denuded, the sutures between the plates on the abactinal surface are marked with purple, forming a network distinctly outlining the coronal plates, especially toward the margins. This color is sometimes continued over a portion of the actinal surface. The color of both dried and alcoholic specimens is a very bright greenish yellow, more or less uniform over both the upper and lower surfaces. Large specimens are sometimes less brightly colored than small ones.

The color of most of the alcoholic specimens of *C. subdepressus*, not denuded, was a dull grayish brown on the abactinal surface, the same color also marking the interambulacral spaces on the actinal surface,

the ambulacral areas being of a dark, dull greenish color. Denuded specimens were purplish gray on the upper surface, and on the lower surface grayish in the interambulacral areas, and dull greenish in the ambulacral. Many specimens of this species were stored in the same tank with *C. Ravenellii*, and became strongly tinged with yellow, giving them at first sight the general appearance of the latter species.

In *C. Ravenellii* where the test has been injured by accident, the injured portion is frequently of a bright green color. The same color in several specimens from station 2417 surrounds small shallow circular cavities which appear to have been produced by some boring animal, perhaps a species of *Stylifer*, but no such forms were found attached.

Clypeaster subdepressus Agassiz.

Station 2317, 45 fathoms (10676); station 2362, 25 fathoms (10625), dead fragment; station 2375, 30 fathoms (8995), a large series, mostly of small size, the largest measuring 90 millimeters in longitudinal diameter; station 2388, 35 fathoms (8992); station 2411, 27 fathoms (8994); station 2414, 26 fathoms (8993).

A few notes regarding this species are given under *Clypeaster Ravenellii*. One specimen from station 2375 had six ambulacral petals and furrows.

Encope Michelini Agassiz.

Station 2375, 30 fathoms (8954); a very fine series, ranging in size from small to large, the largest measuring about 160 millimeters in both longitudinal and transverse diameters. The three anterior lunules in no case form more than slight indentations of the edge of the test. The interambulacral lunule is comparatively small, and the posterior ambulacral lunules are of about the same size, though never closed. The apex is frequently very prominent, that portion of the test bulging greatly. From station 2410, 28 fathoms (8955), a similar but smaller series was obtained. Fragments of dead specimens were dredged at station 2360, 26 fathoms (10621), and station 2362, 25 fathoms (10622).

Conolampas Sigsbei A. Agassiz.

Station 2350, 213 fathoms, three living specimens of medium size (10645), and one small dead specimen (10766); station 2342, 201 fathoms (10762), one very young living specimen.

Palæotropus Josephinæ Lovén.

Station 2327, 182 fathoms (10635), one specimen; station 2341, 143 fathoms (10634), 2 specimens.

Paleopneustes cristatus A. Agassiz.

Station 2332, 156 fathoms (10759), one small specimen; station 2336, 157 fathoms (10761), one fragment.

Paleopneustes hystrix A. Agassiz.

Station 2343, 279 fathoms (10648), one specimen, measuring 63 millimeters in longitudinal diameter. The spines are proportionally fewer

in number and longer than in a specimen measuring 110 millimeters in length, some of them on the dorsal side being fully half as long as the test. The secondary spines are also much more widely scattered on the upper surface.

Linopneustes longispinus A. Agassiz.

Station 2343, 279 fathoms (10646), two specimens each measuring about 68 millimeters in length. The marginal fasciole is not colored differently from the rest of the test.

Hemiaster Mentzi A. Agassiz.

Station 2384, 940 fathoms (10647), one specimen measuring about 30 millimeters in length.

Brissopsis lyrifera Agassiz.

Station 2343, 279 fathoms (10636); station 2378, 68 fathoms (10637), fine series; station 2381, 1,330 fathoms (10638); station 2400, 169 fathoms (10639); station 2401, 142 fathoms (10640), fine series; station 2402, 111 fathoms (10627), dead fragment; station 2404, 60 fathoms (10633), one young specimen.

Agassizia excentrica A. Agassiz.

One living specimen from each of the two following stations: 2341, 143 fathoms (10629); 2345, 184 fathoms (10630).

Metalia pectoralis A. Agassiz.

Station 2362, 25 fathoms (10624), fragments of a dead specimen.

Meoma ventricosa Lütken.

A fine series of this species was obtained from the following localities: station 2362, 25 fathoms (10619), dead fragment; station 2405, 30 fathoms (8996); station 2406, 26 fathoms (8997); station 2411, 27 fathoms (9000); station 2412, 27 fathoms (8998); station 2414, 26 fathoms (8999).

Schizaster (Periaster) limicola A. Agassiz.

Station 2378, 68 fathoms (10641), 2 small specimens; station 2401, 142 fathoms (10642), 5 large specimens.

LISTS OF THE SPECIES OBTAINED IN 1884 *AND* 1885, *ARRANGED ACCORDING TO LOCALITIES.*

ATLANTIC COAST OF THE SOUTHERN STATES.

Off South Carolina; 88 to 99 fathoms, coarse and fine sand, broken shells. Stations 2312, 2313, 2417, 2418 (1885).

Dorocidaris papillata, var.
Clypeaster Ravenellii.

Off Fernandina, Fla.; 440 fathoms, coral, coarse sand, shells, &c. Station 2415 (1885).

Dorocidaris papillata.
Porocidaris Sharreri.
Asthenosoma hystrix.

GULF OF MEXICO.

Between the delta of the Mississippi River and Cedar Keys, Fla., 1885.

21 to 60 fathoms; sand, gravel, coral, broken shells; stations 2369–2375, 2388, 2404–2408.

Cidaris tribuloides.
Dorocidaris papillata, var.
Arbacia punctulata.
Diadema setosum.
Temnechinus maculatus.
Toxopneustes variegatus.
Clypeaster Ravenellii.
Clypeaster subdepressus.
Encope Michelini.
Brissopsis lyrifera.
Meoma ventricosa.

68 to 169 fathoms; gray and green mud; stations 2378, 2400–2403.

Clypeaster Ravenellii.
Brissopsis lyrifera.
Schizaster (Periaster) limicola.

324 to 730 fathoms; gray mud; stations 2376, 2385, 2392, 2393, 2395.

Aspidodiadema antillarum.
Phormosoma placenta.

940 to 1330 fathoms; mud; stations 2381, 2383, 2384.

Phormosoma placenta.
Hemiaster Mentzi.
Brissopsis lyrifera.

Between Tampa Bay and the Dry Tortugas, Florida; 24 to 28 fathoms, coarse and fine sand, and broken shells. Stations 2409–2414 (1885).

Cidaris tribuloides.
Arbacia punctulata.
Clypeaster subdepressus.
Encope Michelini.
Meoma ventricosa.

Off Key West, Fla.; 37 to 50 fathoms; coral bottom. Stations 2315–2318 (1885).

Cidaris tribuloides.
Dorocidaris papillata, var.
Cœlopleurus floridanus.
Toxopneustes variegatus.
Clypeaster Ravenellii.
Clypeaster subdepressus.

Off Havana, Cuba; 29 to 387 fathoms; coral and sandy bottoms. Stations 2152–2154, 2157, 2159, 2161–2164, 2166, 2167 (1884); 2319–2327,

2330, 2331–2338, 2341–2343, 2345–2350 (1885). These stations are mostly from $1\frac{1}{2}$ to 5 nautical miles northeast of Havana Light, and from $\frac{1}{2}$ to $3\frac{1}{2}$ miles off shore. A few, however, are about 2 miles northwest of the light.

	Fathoms.	
Cidaris tribuloides	33 to	201
Dorocidaris Bartletti	33	204
Dorocidaris Blakei	122	387
Dorocidaris papillata	29	387
Dorocidaris papillata, var		67
Porocidaris Sharreri	143	211
Salenia Pattersonii	67	279
Cœlopleurus floridanus	67	216
Diadema setosum		169
Aspidodiadema Jacobyi	192	216
Asthenosoma hystrix		213
Trigonocidaris albida	98	279
Toxopneustes variegatus	98	216
Echinocyamus pusillus		201
Conolampas Sigsbei		213
Palæotropus Josephinæ	143	182
Paleopneustes cristatus	156	157
Paleopneustes hystrix		279
Linopneustes longispinus	29	279
Brissopsis lyrifera		279
Agassizia excentrica	98	184

Off the west coast of Cuba; 426 to 463 fathoms; coral bottom. Stations 2351, 2352 (1885).

Dorocidaris papillata, var.
Echinocyamus pusillus.

Off Cape Catoche, Yucatan; 21 to 26 fathoms, coral and sandy bottoms. Stations 2360, 2362, 2363, 2365 (1885).

Cidaris tribuloides.
Porocidaris Sharreri.
Arbacia punctulata.
Diadema setosum.
Toxopneustes variegatus.
Clypeaster subdepressus.
Encope Michelini.
Metalia pectoralis.
Meoma ventricosa.

CARIBBEAN SEA.

Off Arrowsmith Bank, Yucatan; 130 fathoms, coral bottom. Station 2354 (1885).

Porocidaris Sharreri.
Echinocyamus pusillus.

Off Cozumel Island, Yucatan; 178 to 231 fathoms, coral bottom. Stations 2357–2358 (1885).

Aspidodiadema Jacobyi.
Asthenosoma hystrix.
Trigonocidaris albida.
Echinocyamus pusillus.

Off Santiago de Cuba, near shore; 202 to 400 fathoms, mud, sand, hard coral. Stations 2128, 2129, 2131, 2134, 2135 (1884).

Dorocidaris Blakei.
Dorocidaris papillata.
Aspidodiadema Jacobyi.

Off southeast end of Cuba; 1,639 fathoms, greenish mud. Station 2127 (1884).

Salenia varispina.
Aspidodiadema antillarum.

Off Port Royal, Jamaica; 215 fathoms, black mud. Station 2139 (1884).

Diadema setosum.

Albatross Bank, between Jamaica and Hayti; 23 fathoms, corals and broken shells. Station 2138 (1884).

Cidaris tribuloides.
Dorocidaris Bartletti.
Diadema setosum.
Toxopneustes variegatus.

Off Aves Island; 683 fathoms, yellow mud, fine sand. Station 2117 (1884).

Salenia varispina.
Phormosoma placenta.
Homolampas fragilis.
Aceste bellidifera.

Off St. Vincent; 690 fathoms, gray mud. Station 2118 (1884).
Salenia varispina.

Off Gulf de Morrosquillo, United States of Colombia; 155 fathoms, green mud. Station 2143 (1884).

Aspidodiadema Jacobyi.
Phormosoma placenta.

Off Aspinwall, Panama; 25 to 34 fathoms, green mud, broken shells. Stations 2145, 2146 (1884).

Cidaris tribuloides.
Brissopsis lyrifera.

Off Old Providence Island; 382 fathoms, coral sand. Station 2150 (1884).

Echinocyamus pusillus.
Aceste bellidifera.

SHORE STATIONS.

Key West, Fla:

Diadema setosum.
Echinometra subangularis.
Toxopneustes variegatus.
Hipponoë esculenta.
Echinanthus rosaceus.

Cape San Antonio, Cuba:

Toxopneustes variegatus.
Echinanthus rosaceus.

Cozumel Island, Yucatan:

Hipponoë esculenta.

Jamaica:

Echinometra viridis.
Toxopneustes variegatus.

Old Providence Island:

Diadema setosum.
Echinometra subangularis.
Hipponoë esculenta.
Mellita sexforis.

Sabanilla, United States of Colombia:

Cidaris tribuloides.
Echinometra subangularis.
Toxopneustes variegatus.
Hipponoë esculenta.
Encope emarginata.

Curaçao Island:

Diadema setosum.
Echinometra subangularis.
Toxopneustes variegatus.
Hipponoë esculenta.

St. Thomas:

Cidaris tribuloides.
Diadema setosum.
Echinometra subangularis.
Echinometra viridis.
Toxopneustes variegatus.
Hipponoë esculenta.
Echinanthus rosaceus.

LIST OF A FEW SPECIES OF BIRDS NEW TO THE FAUNA OF GAUDELOUPE, WEST INDIES, WITH A DESCRIPTION OF A NEW SPECIES OF CERYLE.

R.

By GEORGE N. LAWRENCE.

The birds now enumerated I received from Dr. St. F. Colardeau, who wrote concerning them, as follows:

"Five or six of these birds, I believe, have never been observed, or described as being visitors to the Lesser Antilles; they have been collected in our mountains by my son or myself; others were found by Mr. Fred. A. Ober, in the other islands, but not in Guadeloupe.

"I would be very thankful to receive the result of your examination and classification of these specimens."

Dr. Colardeau was correct in his supposition as regards the names of five of the species; the others he did not attempt to determine. As he has sent some interesting notes of the habits of several of the species, they are included and are designated by quotation marks.

Mr. Charles Colardeau, the doctor's son, wrote me:

"My father thinks, and I am of the same opinion, that there are still some birds in the mountains of our island which have not been killed there yet, such as the Siffleur Montagne, which Mr. Ober found in Dominica. There is but a short distance between the two islands, and they are so much alike in their volcanic structure that there seems to be no reason why this bird should not be found in one as well as the other."

+1. **Mniotilta varia** (Linn.). "Black and White Creeper."

"This bird is pretty common during the winter months, disappearing at the beginning of May until the end of October or beginning of November; habits same as those described by Wilson. Seen from October to May."

This species was not found by Mr. Ober in any of the islands of the Lesser Antilles.

+2. **Parula americana** (Linn.). "Blue Yellow-backed Warbler."

"Not plentiful—seen in pais-daux trees on the mountains from December to March. Very active amongst the upper branches and flying away with a sharp 'peep' when alarmed. No nest ever found and supposed not to reside all the year in Guadeloupe."

Not obtained by Mr. Ober in any of the islands of the Lesser Antilles.

+3. **Perissoglossa tigrina** (Gmel.). "Cape May Warbler."

"This bird was shot badly in the vent and the sex could not be made out. The specimen sent is supposed to be a female. Quite rare and seen only in the mountains, amongst the rows of pais-daux trees used to shelter the coffee bushes. From November to April."

Dr. Colardeau was correct in his supposition regarding the name of this species; but the specimen proved to be a male. He also sent the female, which he was not able to identify. He says of it:

"For want of a proper opportunity, nearly three weeks elapsed before this bird was secured after having been seen. During this time it was noticed daily, creeping through the branches of a single pais-daux tree growing in a yard of the town of Basse-Terre, Guadeloupe, picking little bugs and worms from the leaves, a few blossoms being then on the tree. It acted like warblers generally, but had motions something like the creepers, although it was never seen to alight on the sides of the branches. It appeared quite tame and was finally shot by my son on the 11th of February, 1882.

"After being secured, I was told that it was not uncommon in the neighborhood. This, however, I must doubt until further proof, as I cannot trust the sayings of anybody here about birds."

This is also new to the fauna of the Lesser Antilles.

4. **Dendrœca striata** (Forst.). "Warbler."

"These birds, never seen before, were shot at the botanic garden of Basse-Terre, Guadeloupe, on the 10th of October, 1882. They became very plentiful in the immediate neighborhood for eight or ten days, and then suddenly disappeared. On the return of the fall season of 1883, I looked forward for their appearance in the same place, of which I am the director, but none could be discovered. In 1882 a great number could have been secured in a single day."

This species has not been observed before in any of the Lesser Antilles.

5. **Dendrœca virens** (Gmel.). "Black-throated Green Warbler."

"Rather common from November to March. Frequents the upper branches of middle-sized trees, pais-daux principally, among the coffee plantations. Sometimes catches flies in the manner of *Dendrœca plumbea*, while the black-throated blue warbler (*Sylvia canadensis*) frequents the lower undergrowth and is not as common."

6. **Myiarchus oberi**, Lawr. "Ober's Flycatcher; Gros Siffleur."

"Not rare on some mountainous parts of the island. Frequents the top of dead and decaying timbers in the forest. Feeds also on small berries, principally those eaten by *Elainea martinica*."

7. **Blacicus brunneicapillus**, Lawr. "Le Gobe-mouche brun."

"Very little difference between the male and female, which is perhaps a little less bright than the male in coloring.

"This bird frequents the shady undergrowth and edges of forests. Although quite common, it is very little known. It is generally seen during the winter months and early spring in company with its mate. It utters two full notes or whistles while watching for flies and bugs around the large roots of the biggest trees. Is seen also sometimes

among the shady coffee plantations of the mountains. The nest is unknown here."

8. "**Chætura.**"

No specimen sent.

9. **Tringoides macularius** (Linn.).

10. **Sterna hirundo**, Linn.

Ceryle stictipennis. Sp. nov.

Male.—The upper plumage is ashy-blue, with a broad pure white band across the hind neck, connecting with the white of the throat; lores black; a spot of white anterior to the eye, and another of the same color below it; the upper tail-coverts are colored like the back, and are barred on both webs with white; the two middle tail feathers are also colored like the back; the shafts are black, bordered narrowly on each side with deep black; they are conspicuously marked with triangular-shaped white spots on the middle of each web, these are nine in number on each side; the other tail feathers are black, with their outer edges colored like the back, and having pure white spots rounded in form on each web, those on the inner webs are much the largest; all the tail feathers are tipped with white; the quills are black, largely white on their inner webs and marked on the primaries with quadrate white spots on the outer ones, rather far apart; the secondaries have also small white spots on their outer webs, and on the inner webs large round spots, the outer webs are margined with ashy-blue; the tertiaries are largely ash-blue on their outer webs, spotted and barred with white, the inner webs are brownish-black and marked with large spots of white; the wing-coverts are like the back in color, the larger ones are sparsely marked with small white spots; the scapulars are narrowly barred with white; the under wing-coverts are white, largely intermixed with cinnamon color; the throat is white; the lower part of the neck, the breast, and the abdomen are of a very dark cinnamon color; the lower part of the abdomen, the flanks, crissum and under tail-coverts are white, closely spotted and barred with rather dull ashy-blue; the tarsi and toes are dark brown; the bill is black, with the basal half of the under mandible yellow.

Length, fresh, 17 inches; wing, $7\frac{3}{4}$; tail, $5\frac{1}{2}$; bill, 3.

Habitat.—Guadeloupe, West Indies.

Type in my collection.

Female.—The color above is similar to that of the male, but it has the entire back and wings marked sparsely with small white spots; in the markings on the head, wings, and tail they are much alike; it has the white throat and band on the hind neck as in the male; across the lower part of the throat and upper part of the breast there is a broad band of ashy-blue, minutely freckled with white; this band is bordered narrowly below with white; the entire under plumage besides, and the under wing-coverts are deep cinnamon.

Length skin, $17\frac{1}{2}$ inches; wing, 8; tail, $5\frac{3}{4}$; bill, 3.

The type of the female is in the National Museum, Washington, to which it was sent from Guadeloupe by Mr. L. Guesde.

Remarks.—I have for comparison two males and four females of *C. torquata.* The male of the new species differs from the same sex of *torquata* in the upper plumage being rather duller in color, and strikingly so in having the feathers of the back and wings barred with white seen on the back by raising them, whereas in *C. torquata* these feathers are immaculate; the quills are of a deeper black and have their outer webs conspicuously spotted with white, whereas in *torquata* they are unspotted; the cinnamon color below is rather darker than in the other species, and the lower part of the abdomen and under tail-coverts are closely spotted and barred with ashy-blue; in one of the males of *torquata* there are a few spots on the lower abdomen and under tail-coverts; the other has these parts pure white; the new species has the under wing-coverts white, blotched with cinnamon, those of *torquata* being pure white; the wings are longer than in *torquata.*

The female differs from that sex of *C. torquata* in having the outer webs of the quill feathers spotted with white, and in the upper plumage and wings being conspicuously spotted with white, and in having the under plumage darker in color; in one specimen of *C. torquata* there are no spots; in the other three there are concealed spots of white on the back, and in one of them from Jalapa, Mexico, there are a few spots showing on the wings, and this specimen has white spots on the outer web of the first primary, the outer webs of the quill feathers in the other three are without spots; the bluish band across the breast is freckled with minute spots of white; this character is seen only in the Jalapa specimen, but in a much less degree; this specimen, however, has not the general spotted appearance of the new species; the white bands on the central tail feathers are more strongly marked than in *C. torquata.*

For a long time I have been very desirous to see the large kingfisher from Guadeloupe, which had been known there as "*Ceryle torquata*" from specimens in the museum at Pointe a Pitre. It was not obtained by Mr. Ober, and is given in his catalogue from these specimens. I thought from its isolated position (none being recorded from any other island of the West Indies or found nearer than Central or South America) that it might differ from *C. torquata.* Last summer I was gratified by receiving a specimen of the male from Dr. Colardeau. On a comparison with numerous specimens of *C. torquata*, I came to the conclusion that it was a distinct species. I requested Mr. Ridgway to lend me the specimens of *C. torquata* in the National Museum; he kindly sent three specimens so labeled, all females; fortunately one of them was from Guadeloupe, thus giving me the opportunity to examine both sexes.

Dr. Colardeau wrote me: "I have a fine skin of *Ceryle torquata* for you. It was shot by my son in a large mountain stream crossing the

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botanic garden, which is situated at about one mile from the sea, at Basse-Terre. Its mate was seen at the same time, but could not be obtained. There are now several specimens at the museum of Pointe a Pitre. Mr. Vetrac lately showed me two, which he assured me were young ones, taken from the nest in a cliffy bank, but in size and coloring they did not differ apparently from adults. However, I did not observe them very closely."

From Mr. Charles Colardeau I received the following account:

"The large Kingfishers, *C. torquata*, are very rare, and when seen are very hard to secure, as they are very wild. I only saw three in two years, although I hunted a great deal for them."

OCTOBER 20, 1885.

REMARKS UPON THE PLUMAGE OF REGULUS CALENDULA.

R.

By CHARLES WICKLIFFE BECKHAM.

As the books appear to be considerably at sea as to the presence of the brightly colored crown-patch of the Ruby-crowned Kinglet in females and young autumnal birds, it may not be out of place to attempt the elucidation of the matter.

Wilson, Audubon, and Nuttall all say substantially the same thing in regard to the female—that it is similar to the male; and in Audubon's plate of the species the female, as well as the male, is figured with the brilliant scarlet-vermilion crown. As to the presence of this ornament in young birds in the fall they are all silent. In "Birds of North America," 1858, p. 227, it is stated that "the female differs very little in color. It is quite probable that the species does not attain the red patch in the crown until the second year, as the spring migrations of the species always embrace a considerable number with the head perfectly plain."

The "History of North American Birds," 1874, Vol. I, p. 75, gets nearer to the truth than any of the other authorities by saying, "Female and young without the red on the crown."

In the "American Naturalist" for 1870 (IV, p. 54), Mr. Allen, in a brief note, questions the possession of the crown-patch by the female, and calls for the "experience of others." Mr. Dall, in the same volume, p. 376, mentions that he "took ten or twelve specimens in May and June in Alaska, all of which had the red crown, and proved on examination to be males." He saw no females at all. Dr. Coues, in the same volume, p. 316, in the "Key," 1872, p. 78, andin "Birds of the Northwest," 1874, p. 16,* expresses the belief that the male and female are similarly

* "There has been some discussion respecting a supposed sexual difference in the scarlet crest of this species. But the fact is that both sexes possess this ornament,

decorated, but he adduces no evidence in support of this supposition. In the "Birds of the Colorado Valley," 1878, p. 93, and in the second edition of the "Key," 1884, p. 259, he expresses a doubt upon this point. He says (*ll. cc.*): "This beautiful ornament is apparently not gained until the second year, and there is a question whether it is ever present in the female. * * * Young for the first year (and ♀ ?) quite like the adult, but wanting the scarlet patch."

The "British Museum Catalogue of Birds," Vol. VIII, p. 85, "keeps the ball rolling," denying the crown to the young bird, but silent as to its possession by the female. In fact, the same statement, in substance, runs through all the books I have seen that have had occasion to describe the plumage of this abundant and interesting little bird.

As regards the alleged presence of the ornament in the female, it is difficult to see how this error could have so long prevailed. In addition to the large series of the National Museum, I have examined a good many others, amounting in the aggregate to about 125 specimens, and but one of those having a red crown-patch purports to be a female. This skin, No. 10937 U. S. N. M., was collected in April, 1858, at Fort Bridger, Utah, by Mr. C. Drexler; but this determination may be set aside as in all probability erroneous. The error originated with the older American ornithologists, who, knowing that the females of all the other *Regulinæ* had a brightly colored crown, although differing from that of the male, doubtless took it for granted that this one had it also.

The presence of this character in young autumnal males is a fact that I have but recently ascertained. During October of this year (1885) I took four young males, and Mr. William Palmer, of Washington, two, all with the brightly colored crown; three of the former were taken on the same day. I took particular pains in determining the fact that they were young birds, and Mr. Palmer informs me that he exercised the same care with his two specimens. This point was easy enough to determine, on account of the very incomplete ossification of the various parts of the skeleton, particularly the skull, the softness of the rictal membrane, &c. Altogether I shot seven of the birds this fall, all of them "birds of the year"—four males, as above stated, with the bright crown, one male without the crown (shot in September), one female, and one (without the crown) whose sex, on account of the mutilation of the parts, was not determinable. This would seem to indicate the numerical preponderance of the young males with the crown over those without this decoration. The large series I had under examination contains a good many fall males with the crown, and I have no doubt that most of them were birds of the year, a fact of easy de-

and that neither gains it for at least one year is proved by the circumstance that in the spring migrations a number of individuals are found with the head perfectly plain. The sexes are never positively distinguishable by outward characters. In this respect the species differs from *R. satrapa*, the female of which lacks the scarlet central patch in the yellow of the crown."

termination in the way above indicated, but one which the respective collectors, not realizing the importance thereof, failed to ascertain.

The explanation of the fact that some males are taken in spring without this coronal decoration is not very easily found, and the only one I can advance—a not very satisfactory one, it must be admitted—is that they are birds of very late broods, which for this or some other reason have not undergone the fall molt.

Two of the birds shot this fall, and several more found in the National Museum collection, exhibit such a remarkable difference in the color of the crown from the normal scarlet-vermilion that it may be well to indicate them in detail:

No. 1971 (Coll. C. W. B.), ♂ *hornot.* Ilchester, Md., October 25, 1885. Collected by C. W. Beckham.

No. 59315 (U. S. N. M.). Washington, D. C., October 20, 1859 (not "sexed," but undoubtedly a male, and probably a *hornotine*). Collected by D. W. Prentiss.

The color of the crown in these two specimens is almost exactly of the same shade, *i. e.*, a pale red-lead approaching orpiment-orange,* and there is a tendency to pale vermilion toward the ends of the feathers, a few of which are tipped with dusky, and the white at the bases is more pronounced than in any other specimens examined.

No. 1481 (Coll. W. P.), ♂ *hornot.* Alexandria County, Virginia, October 25, 1885. Collected by William Palmer.

This is the most interesting skin of the series, the feathers of the crown being white at the base, passing insensibly into a light yellow, and then into vermilion towards the tips, perhaps indicating that the feathers change into the normal scarlet-vermilion without molting.

No. 60955 (U. S. N. M.). Henry's Fork of Green River, October 3, 1870 (not "sexed," but doubtless a male of the year). Collected by H. D. Smith. Quite similar to the last, but the contrast between the yellow and vermilion is not so marked as in that one.

No. 66706. (U. S. N. M.), ♂. Fort Garland, Colo., May 30, 1873. Collected by H. W. Henshaw.

The crown of this specimen is quite like those of the first two, but of a more decided reddish hue, approaching the usual scarlet-vermilion. This is the only spring male of the series that has this yellowish crown, but the feathers of the general plumage are very much abraded and decomposed—almost mere shreds—showing that the bird had not molted at the usual time and was still wearing his last year's clothes. With this explanation I think it may be safely assumed that this pale-yellowish crown is a peculiarity of the fall plumage of some young males. Whether it pertains to an early plumage of all of them, and subse-

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* These color terms are those adopted in Mr. Ridgway's forthcoming manual, "A Nomenclature of Colors for the Use of Naturalists, and a Compendium of Useful Knowledge for Ornithologists."

quently gives place to the scarlet-vermilion, in the light of our present knowledge, can only be a matter of conjecture.

These two points, however, may be regarded as pretty well settled: (1) that the female does not have this brightly-colored crown, and (2) that some young autumnal males (very likely a large majority of them) do possess this ornament.

In regard to the use of this decoration, I strongly suspect it to be not merely an ornament induced by sexual selection for the delectation of the female, but of considerable service to the bird in his "entomophagical" pursuits. But as I have no evidence to offer upon the subject, it would be unprofitable to discuss it here.

A careful comparison of Eastern with Western Province specimens fails to reveal any tangible differences of plumage or structure.

NOTICE OF A COLLECTION OF STALKED CRINOIDS MADE BY THE STEAMER ALBATROSS IN THE GULF OF MEXICO AND CARIBBEAN SEA, 1884 AND 1885.

By RICHARD RATHBUN.

During the early part of 1884 and of 1885, the U. S. Fish Commission steamer Albatross, Lieut. Commander Z. L. Tanner, U. S. N., commanding, was engaged in exploration to the south and southeast of the United States. The former year, under the direction of the Hydrographic Bureau of the U. S. Navy, she was mainly employed in making sounding observations in the Caribbean Sea region; but a short stop for dredging purposes was made off Havana, Cuba, where the U. S. Coast Survey steamer Blake had already discovered a rich assemblage of stalked crinoids. In 1885 the Albatross remained about three months in the Gulf of Mexico, visiting the same locality off Havana, and adding very largely to the natural-history results of the previous year. Brief accounts of these two cruises have already been given in this volume of Proceedings (pp. 83 and 606).

Stalked crinoids were collected off Havana, Cuba, off Santiago de Cuba, and in the northeastern part of the Gulf of Mexico, off the coast of Florida. Only four species were obtained—*Rhizocrinus Rawsoni*, *Pentacrinus decorus*, *P. Mülleri*, and P. *asterius*. The first-mentioned species was taken at all of the above localities, *Pentacrinus decorus* and *P. asterius* off Havana only, and *P. Mülleri* off Havana and off Santiago de Cuba.

The collection made off Havana is an exceedingly fine one, containing over 600 specimens, a large proportion of which are in a very perfect state of preservation, due to the great care bestowed upon them by the naturalists on board. As regards this locality, Mr. James E. Benedict, the chief naturalist of the Albatross, states that all the specimens of sea-lilies were obtained to the eastward, and within sight, of

the harbor of Havana. The water deepens rapidly from the shore to a depth of several hundred fathoms, and the bottom is very rough. The tangles only could be used for collecting, and the exact depth at which all the specimens were taken could not be determined, as the depth generally increased during the progress of every haul, the tangles being usually dragged diagonally off shore from the places where they were lowered. The range of depth given in connection with each species is probably approximately correct, but *P. Mülleri* appears to be limited to more shallow water than *P. decorus.*

As the tangles were hauled on board, the "lilies" generally hung with the arms downward; they were cut as quickly as possible from the hemp swabs, and placed in large, deep dishes, about two-thirds full of alcohol, in which they gave off immediately a rich reddish-brown color. They were afterwards transferred to the large copper tanks and large jars. *P. Mülleri* retains more of its natural color in alcohol than *P. decorus.*

The writer has made a careful examination of all the specimens for the purpose of determining the species represented, but the collection merits more critical study, without which it would be impossible to enlarge upon the results already published by Dr. P. H. Carpenter in his recent Challenger volume,* in which he discusses the collection made in the same region by the Coast Survey steamer Blake. Of great interest are the more or less complete series of the young of three species, which are deserving of careful study.

Rhizocrinus Rawsoni Pourtalès.

P. H. Carpenter, Report upon the Crinoidea collected by H. M. S. Challenger, 1873–'76, Part I, 1884, p. 262.

Many examples of this species were collected by the steamer Albatross in the Gulf of Mexico, in 1885, but in the cruise of the preceding winter but a single specimen was obtained, and that was taken at station 2129, south of Cuba. The greatest number were obtained southeast of Pensacola, Fla., in depths of 88 to 196 fathoms, over one hundred specimens having been dredged in a single haul at station 2401, 142 fathoms.

As usually happens with this species, but a very small proportion of the specimens retain their arms, the rough handling to which they are naturally subjected in the trawl-net, filled with materials of all kinds, tending to break off the more delicate and loosely jointed appendages. The series from station 2401 is an exceedingly interesting one, containing individuals of all sizes, from those measuring about 23^{mm} in length of stem to others with the stem fully 280^{mm}. in length, the latter being much larger than any yet recorded. Among the smaller

* The Voyage of H. M. S. Challenger. Zoology. Report upon the Crinoidea collected during the Voyage of H. M. S. Challenger, during the Years 1873–'76. By P. Herbert Carpenter, D. Sc., assistant master at Eton College. Part I. General Morphology, with Descriptions of the Stalked Crinoids. 1884.

specimens there are several which appear to resemble *Rhizocrinus lofotensis* more or less closely as regards the joints of the stem, the shape of the calyx, and the structure of the arms; but this resemblance is probably superficial, for the most extreme forms in this direction are connected, by many specimens showing intermediate gradations, with specimens that are typical of *R. Rawsoni.* Unfortunately *R. lofotensis* is very poorly represented in the National Museum collections, thereby precluding careful comparisons with it.

The entire collection exhibits a considerable range of variation, but nothing beyond what has been already noticed by Dr. P. H. Carpenter, unless it may be in the instance above mentioned. In nearly all the specimens from the northern part of the Gulf of Mexico (stations 2399, 2401, 2402, 2403) the calyx is proportionally broad above, expanding rather rapidly from the stem upward, and with scarcely ever any noticeable restriction around the radials. The specimens from this region are all very much alike as to the shape of the calyx, and in this particular differ from those taken off Havana (stations 2321, 2326, 2327, 2337, 2345) and south of Cuba (station 2129), in which the calyx is proportionally longer and narrower with frequently a more pronounced radial constriction. The stem is almost always smallest at the calyx, being sometimes very small at that point; quite perfect dice-box shaped joints are not uncommon, especially low down on the stem; the longest joints scarcely ever exceed twice the diameter in length.

Following are given measurements of three of the larger specimens from station 2401. The arms are perfectly preserved only in No. 1.

Dimensions of three large specimens from station 2401.

	No. 1.	No. 2.	No. 3.
Length of stem .... millimeters..	190	248	280
Number of joints in stem........	74	96	106
Length of stem joints near middle........ millimeters..	3	2.6	3
Diameter of same .... do......	1.5	1.5	1.9
Height of basal tube .... do......	4	3.8	3.5
Greatest diameter of same .... do......	2.8	2.8	2.5
Height of calyx .... do......	5	4.8	4.5
Greatest diameter of same .... do......	3	3	2.9
Length of arms........ do......	45	....	....
Number of double joints in same	About 42	....	....

RECORD OF SPECIMENS

Gulf of Mexico, southeast of Pensacola, Fla.:

Latitude 28° 44′ N., longitude 86° 18′ W., 196 fathoms, gy. M.; station 2399, two specimens (12348).*

Latitude 28° 38′ 30″ N., longitude 85° 52′ 30″ W., 142 fathoms, gn. M. brk. Sh.; station 2401, one hundred specimens (12354).

Latitude 28° 36′ N., longitude 85° 33′ 30″ W., 111 fathoms, gy. M.; station 2402, three specimens (12352).

Latitude 28° 42′ 30″ N., longitude 85° 29′ W., 88 fathoms, gy. M.; station 2403, one specimen (12349).

* The numbers in parentheses are catalogue numbers of the U. S. National Museum.

Off Havana, Cuba:

Station 2321, 230 fathoms, fne. gy. S., one specimen (12353).
Station 2326, 194 fathoms, Cr., one specimen (12346).
Station 2327, 182 fathoms, fne. S., one specimen (12351).
Station 2337, 199 fathoms, Cr., three specimens (12350).
Station 2345, 184 fathoms, gy. wh. Cr., one specimen (12347).

South of Cuba:

Latitude 19° 56′ 04″ N., longitude 75° 48′ 55″ W., 274 fathoms, bn. M. fne. S.; station 2129, one specimen (7109).

Pentacrinus decorus Wyville Thomson.

P. H. Carpenter, *loc. cit.*, p. 330.

The number of specimens of *Pentacrinus decorus* obtained was not far from 500, and all were taken off Havana, Cuba, in depths of 67 to 279 fathoms. The series is an exceedingly fine one, presenting all stages of growth from the smallest to the largest described by Dr. Carpenter, but very young specimens are comparatively rare. A hasty examination of the collection furnishes no important facts to add to Carpenter's very full description. From 28 to 30 arms were noticed in a number of specimens, and one specimen has 38 arms. In the last the branching is regular on some rays and irregular on others; the several rays bear from 5 to 10 arms each, as follows: 5, 10, 8, 8, 7. The ray bearing 10 arms is divided as follows: The 2 primaries have 2 distichals each. The primary on the right divides into two secondaries, the outer one with 3 palmars, terminating in 2 free arms, the inner with 4 palmars, followed by a free arm on the right, and a tertiary (if so we may call it) on the left, the latter having 6 joints and ending in 2 free arms. The inner secondary of the left primary has 5 palmars and 2 free arms; the outer secondary, 1 palmar, a free arm on the right, and a tertiary of 3 joints on the left, followed by 2 free arms. The height from the basals to the tips of the arms is about 100^{mm}, but, excepting for the greater fullness of the cluster of arms, the specimen appears to be perfectly normal.

The youngest specimen is of about the same relative size as the smallest described and figured by Dr. Carpenter (*loc. cit.*, p. 21, pl. xxxv, fig. 1).

RECORD OF SPECIMENS.

Off Havana, Cuba:

Stations 2156 to 2169, 78 to 278 fathoms, 1884, 125 + specimens (12355).
Stations 2319 to 2350, 67 to 279 fathoms, 1885, 300 + specimens (12356).

(*Young specimens.*)

Off Havana, Cuba:

Stations 2156–2169 (12571); station 2161, 146 fathoms (12568); station 2167, 201 fathoms (12569); station 2169, 78 fathoms (12570); stations 2319–2350 (12567); station 2335, 204 fathoms (12361); station 2346, 200 fathoms (12359, 12566); station 2347, 216 fathoms (12362); station 2348, 211 fathoms (12360); station 2349, 182 fathoms (12565).

Pentacrinus Mülleri Oersted.

P. H. Carpenter, *loc. cit.*, p. 306.

About one hundred specimens in all of this species were collected on the two cruises, by far the greater number having been obtained in 1885. The greatest length of arm observed was 164^{mm}, with 134 joints, the calyx and arms being exceptionally perfect, but the stem short. Others nearly as large are contained in the collection. The longest stem measures slightly more than 350^{mm} in length, and includes 29 internodes, with 8 to 9 internodal joints; the diameter of the stem is 5.5^{mm}; the length of the longest arm 135^{mm}. The next longest stem measures 280^{mm} in length, 5.5^{mm} in diameter, and has 25 internodes with 9 internodal joints each. The shortest internodes observed occur in a stem 222^{mm} long; diameter of stem 5.8^{mm}; number of internodes, 28; length of internodes, 7^{mm}; number of internodal joints, 7. The usual number of joints to an internode is 7 to 11, but as few as 5 and 6 were noticed in some adult specimens.

The stem differs greatly in shape, being sometimes very rounded pentagonal, with but a slight longitudinal depression on each face, while again this depression may be very wide and pronounced and the edges quite angular. In the larger number of specimens the internodal joints are subequal in length, and in only a comparatively small number are they regularly alternating, as thin and thick. In some specimens this latter arrangement occurs irregularly on portions of the stem.

The color varies greatly in alcoholic specimens, the variation being probably due in part to the manner of preservation. Nearly half the specimens have a tinge of green, varying to bluish, this color being sometimes very light, at others dark. Many specimens are very light purplish, purplish white or yellowish white. Light shades of brown and gray also occur, and several varieties of coloring may be found on the same specimen. The lower arm joints and calyx are generally darker than the rest of the body, being often of a dark olive color.

Comparatively few young specimens of *Pentacrinus* were obtained, considering the large size of the entire collection made. From among the young specimens examined about eight appear to belong to this species, although where only short stems occur it is very difficult to distinguish this species from *P. decorus.* A sufficiently complete series, ranging from the largest to the smallest, has, however, been brought together, to render the identifications presumably accurate. The differences observed in the stems of adult specimens occur also among the young. The internodal joints are generally of subequal length, but in two specimens thick and thin joints alternate, although the differences between them are not very great.

The youngest specimen in the lot and one of intermediate size furnish the following measurements and other details:

Dimensions of two young specimens.

	Smallest specimen.	Intermediate specimen.
Total length .... millimeters..	28	66
Length of stem .... do......	12	26
Number of internodes	7	7
Number of internodal joints	3	6
Length of cirri .... millimeters..	5	16
Number of joints in cirri	12	24
Diameter of calyx (top of first radials) .... millimeters..	2.8	4.6
Height from point of attachment of stem to upper edge of third radials .... millimeters..	3.2	5
Number of free arms	10	27
Length of arms .... millimeters..	15	38
Number of joints in arms	19	44

In the smaller specimen the interarticular pores extend through the upper three or four internodes, and in the latter through the same number; in the former the radials are proportionally longer; the basals are comparatively large in both. In the smaller each ray divides regularly into two arms; in the larger into 5 or 6 arms each, with two distichals and two palmars.

There are in the collection of 1884 two interesting specimens that appear to be modifications of this species in the direction mentioned by Carpenter (*loc. cit.*, p. 311), with respect to two specimens collected by the Coast Survey steamer Blake off Martinique and Barbadoes; but the extent of the variation in our specimens is much greater, though mainly limited to the lower brachials of the arms. One specimen came from station 2134, south of Cuba, depth 254 fathoms; the other is from a depth of 300 fathoms, at station 2155, off Havana. For convenience in describing them we will designate the former A, the latter B. With specimen A one typical example of *P. Mülleri* was collected, and B came from the same locality where the largest hauls of this species were made, though it was the only specimen obtained at that particular station. Both specimens are in very perfect condition, A being slightly larger than B. In A the stem is 168^{mm} long, with 19 internodes, and terminates with a nodal joint; the diameter of the stem is 4.2^{mm}, the number of internodal joints 7. The stem is very decidedly pentagonal in A, but in B is more rounded; in both, the joints are of subequal length; the cirri in A are about 34^{mm} long, and consist of 33 joints each.

The basals are very small, and very widely separated in A, but in B they are somewhat larger and touch slightly exteriorly. There are three radials on each ray of both specimens, in A being comparatively low and broad; the diameter of the calyx at the top of the first radials in A is 9^{mm}. In the latter there are 30 arms, each ray dividing regularly into 6, the arrangement being 2. 1; 1. 2; there are two distichals and three palmars; the longest free arm measures 103^{mm}, and consists of 88 joints. The surfaces of all the joints of the calyx and arms, up to and including the first brachial, are slightly more raised, and appear harder and

smoother than the remaining brachials, as often happens in this species; they are also darker in color. The free arms above the first brachials appear much more delicate and are of a lighter color. The lower 7 or 8 brachials on each arm are much flattened, dorsally and laterally, the edges along which these surfaces meet being more or less sharply angular and produced to form narrow wing-like extensions reaching nearly the entire length of the joint, or short, stout, more or less spiniform projections most developed at the upper ends of the joints and directed upward and outward. The one is but a modification of the other, all gradations occurring from the elongate process to the simple spine, the former often breaking up into two or even three spines, the lower of which are much the smaller and generally quite minute. One of the most common conditions is a slightly raised subangular or rounded edge, beginning just above the lower end of the joint and continuing without much, if any, increase in size to near the upper end, where it becomes abruptly enlarged, the spine-like process thus formed being sometimes acutely, at others obtusely, pointed, and often squarely cut off above. Where the raised edge is not continuous, it is generally represented by the one or two smaller spines above mentioned.

In addition to the lateral processes, there is on most of the arms a median series of spines, of about the same length as the lateral ones; but more spine-like in shape, and acutely or bluntly pointed, though occasionally transversely expanded at the tip. They are located at the extreme upper end of the joints, slightly overlapping the next above, are directed upward and outward, and may begin anywhere from the 5th to the 12th brachial. They extend over from 2 to 13 joints, being generally largest below and gradually decreasing in size upward, becoming at the same time more acute and more appressed. Above the flattened brachials the joints become normal. All the joints below the free arms are much more flattened than usual, and some of the palmars and distichals are more or less produced at the sides.

In specimen B the ray and arm joints are all less flattened than in A, and the lateral edges less continuously produced, generally bearing only from 1 to 3 spines, which are smaller and more acute. The median series of spines is more constant, and reaches farther up on the arms, and there are often two, three, or even more spines along the upper edge of each joint, not always regularly arranged, and generally limited to one side or the other. The spines of this series are frequently very broad, thin and square at the upper end.

RECORD OF SPECIMENS.

Off Havana, Cuba:

Stations 2156–2169, 78 to 278 fathoms, Cr., 1884, 16 specimens (12357).

Stations 2319–2350, 67 to 279 fathoms, Cr., 1885, 75 specimens (12358).

South of Cuba:

Latitude 19° 56′ 06″ N., longitude 75° 47′ 32″ W., 254 fathoms; station 2134, 1884, 1 specimen (12547).

(*Young specimens.*)

Off Havana, Cuba:

Station 2152, 387 fathoms (12543); station 2163, 133 fathoms (12545); station 2164, 192 fathoms (12544); station 2166, 196 fathoms (12364); stations 2319–2350 (12542); station 2347, 216 fathoms (12546); station 2349, 182 fathoms (12541). One or two specimens are contained in each of these lots.

(*Variety described in notes.*)

South of Cuba:

Latitude 19° 56′ 06″ N., longitude 75° 47′ 32″ W., 254 fathoms; station 2134, 1884, 1 specimen (12548).

Off Havana, Cuba:

Station 2155, 300 fathoms, Cr., specimen (12549).

Pentacrinus asterius (Linn.) Lütken.

P. H. Carpenter, *loc. cit.*, p. 300.

The lower portion of the stem of a large individual was collected off Havana, Cuba, in 1885. It was associated with *Pentacrinus Mülleri* and *Pentacrinus decorus*, and was only detected when the large collection of specimens made by the Albatross, and contained in several tanks, was being overhauled at the National Museum. The exact locality was, therefore, not noted by the naturalists on board the steamer, but it came from one of the stations, 2319 to 2350 inclusive, with depths of 67 to 279 fathoms. The catalogue number is 12363.

This specimen consists of the lower five internodes and part of another internode above, the upper break presenting an irregular and fresh surface, indicating that the upper part of the stem, with its calyx and arms, had probably been broken off by the tangles at the time this fragment was secured. The lower end of the stem terminates with a nodal joint. The entire length of the stem is about 155^{mm}, the diameter 7^{mm}; the internodes are about 26^{mm} long each, and consist of 18 to 19 joints; the cirri are about 72^{mm} long, with 47 joints.

This stem agrees very well with the description of Dr. Carpenter (*loc. cit.*), and compares favorably with the lower part of his figure given on Plate XI. It adds a new locality to those previously recorded for the species, but we cannot help regretting that a more perfect example was not obtained.

NOTES ON THE GREAT DOLPHIN, CORYPHÆNA HIPPURUS, LINNÉ.

By SILAS STEARNS.*

It is a surface swimmer, living not deeper than half-way to the bottom, in 20 or 30 fathoms of water, and yet never coming into the very shoal water close to the coast. Dolphins are generally distributed over the Gulf of Mexico during the summer months, but in winter the chilly surface water drives them and their food to the lower parts, about the

*Extracted from a letter in reply to inquiries concerning specimen number 37227, accession 16171, forwarded to the Museum by Mr. Stearns about June 17, 1885.—T. H. Bean.

coasts of Cuba and Yucatan. The Great Dolphin is one of the most active and vigorous fishes known to the Gulf fishermen.

It is often seen while in chase of flying-fishes and schools of small-fry, and also while lurking about vessels at anchor on the fishing grounds or becalmed, to pick up any scraps of food that may be thrown overboard. At such times it can be captured with an ordinary small hook and line, or with the more elaborate outfit of rod, reel, and fine line, using a squid or metal spinner, or common fish-bait.

When hooked the dolphin fights hard, jumping and shaking itself to get rid of the hook, and it is well worth the attention of the angler. It is taken only with hook and line, while trolling, or on the red-snapper grounds as above mentioned.

While in the water it presents a beautiful appearance, being graceful in movement and brightly colored. Then the colors mentioned in the description of the species appear much brighter than after the death of the fish.

The dolphin is not a good food-fish. Its flesh is dark and tough.

It spawns in July and August, probably among floating algæ.

PROCEEDINGS UNITED STATES NATIONAL MUSEUM.

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APPENDIX.

[Proceedings United States National Museum, 1885. Appendix.]

SMITHSONIAN INSTITUTION.

UNITED STATES NATIONAL MUSEUM.

No. 32.

CLASSIFICATION OF THE MATERIA MEDICA COLLECTION OF THE U. S. NATIONAL MUSEUM, AND CATALOGUE OF SPECIMENS.

By DR. JAMES M. FLINT, U. S. N.
Revised and extended by
DR. HENRY G. BEYER, U. S. N., HONORARY CURATOR, SECTION OF MATERIA MEDICA.

CLASSIFICATION.

I.—ANIMAL PRODUCTS.
II.—VEGETABLE PRODUCTS.
III.—PRODUCTS OF FERMENTATION AND DISTILLATION.
IV.—INORGANIC PRODUCTS.

I.—ANIMAL PRODUCTS.

VERTEBRATA.

A.—Mammalia:
- I.—Carnivora.
- II.—Cetacea.
- III.—Ungulata.
- IV.—Rodentia.

B.—Aves.
C.—Reptilia.
D.—Amphibia.
E.—Pisces.

MOLLUSCA.

F.—Cephalopoda.
G.—Gastropoda.
H.—Lamellibranchiata.

ARTHROPODA.

I.—INSECTA:
- I.—Coleoptera.
- II.—Hemiptera.
- III.—Hymenoptera.

K.—CRUSTACEA.

VERMES.

L.—ANNELIDA.

CŒLENTERATA.

M.—ACTINOZOA.
N.—SPONGIA.

II.—VEGETABLE PRODUCTS.

[From Bentham and Hooker: GENERA PLANTARUM.]

DICOTYLEDONES.

POLYPETALÆ.

SERIES I.—THALAMIFLORÆ.

Cohort I.—RANALES.
1. Ranunculaceæ.
2. Dilleniaceæ.
3. Calycanthaceæ.
4. Magnoliaceæ.
5. Anonaceæ.
6. Menispermaceæ.
7. Berberideæ.
8. Nymphæaceæ.

Cohort II.—PARIETALES.
9. Sarraceniaceæ.
10. Papaveraceæ.
11. Cruciferæ.
12. Capparideæ.
13. Resedaceæ.
14. Cistineæ.
15. Violarieæ.
16. Canellaceæ.
17. Bixineæ.

Cohort III.—POLYGALINÆ.
18. Pittosporeæ.
19. Tremandreæ.
20. Polygaleæ.

Cohort IV.—CARYOPHYLLINÆ.
21. Frankeniaceæ.
22. Caryophylleæ.
23. Portulaceæ.
24. Tamariscineæ.

Cohort V.—GUTTIFERALES.
25. Elatineæ.
26. Hypericineæ.
27. Guttiferæ.
28. Ternstrœmiaceæ
29. Dipterocarpeæ.
30. Chlaenaceæ.

Cohort VI.—MALVALES.
31. Malvaceæ.
32. Sterculiaceæ.
33. Tiliaceæ.

SERIES II.—DISCIFLORÆ.

Cohort VII.—GERANIALES.

34. Lineæ.
35. Humiriaceæ.
36. Malpighiaceæ.
37. Zygophylleæ.
38. Geraniaceæ.
39. Rutaceæ.
40. Simarubeæ.
41. Ochnaceæ.
42. Burseraceæ.
43. Meliaceæ.
44. Chailletiaceæ.

Cohort VIII.—OLACALES.

45. Olacineæ.
46. Ilicineæ.

Cohort IX.—CELASTRALES.

47. Celastrineæ.
48. Stackhousieæ.
49. Rhamneæ.
50. Ampelideæ.

Cohort X.—SAPINDALES.

51. Sapindaceæ.
52. Sabiaceæ.
53. Anacardiaceæ.
54. Coriarieæ.
55. Moringeæ.

SERIES III.—CALYCIFLORÆ.

Cohort XI.—ROSALES.

56. Connaraceæ.
57. Leguminosæ.
58. Rosaceæ.
59. Saxifrageæ.
60. Crassulaceæ.
61. Droseraceæ.
62. Hamamelideæ.
63. Bruniaceæ.
64. Halorageæ.

Cohort XII.—MYRTALES.

65. Rhizophoreæ.
66. Combretaceæ.
67. Myrtaceæ.
68. Melastomaceæ.
69. Lythrarieæ.
70. Onagrarieæ.

Cohort XIII.—PASSIFLORALES.

71. Samydaceæ.
72. Loaseæ.
73. Turneraceæ.
74. Passifloreæ.
75. Cucurbitaceæ.
76. Begoniaceæ.
77. Datisceæ.

Cohort XIV.—FICOIDALES.

78. Cacteæ.
79. Ficoideæ.

Cohort XV.—UMBELLALES.

80. Umbelliferæ.
81. Araliaceæ.
82. Cornaceæ.

GAMOPETALÆ.

SERIES I.—INFERÆ.

Cohort I.—RUBIALES.

83. Caprifoliaceæ.
84. Rubiaceæ.

Cohort II.—ASTERALES.

85. Valerianeæ.
86. Dipsaceæ.
87. Calycereæ.
88. Compositæ.

Cohort III.—CAMPANALES.

89. Stylidieæ.
90. Goodenovieæ.
91. Campanulaceæ.

SERIES II.—HETEROMERÆ.

Cohort IV.—ERICALES.

92. Vacciniaceæ.
93. Ericaceæ.
94. Monotropeæ.
95. Epacrideæ.
96. Diapensiaceæ.
97. Lennoaceæ.

Cohort V.—PRIMULALES.

98. Plumbagineæ.
99. Primulaceæ.
100. Myrsineæ.

Cohort VI.—EBENALES.

101. Sapotaceæ.
102. Ebenaceæ.
103. Styraceæ.

Jan. 20, 1886.

Series III.—BICARPELLATÆ.

Cohort VII.—Gentianales.

104. Oleaceæ.
105. Salvadoraceæ.
106. Apocynaceæ.
107. Asclepiadeæ.
108. Loganiaceæ.
109. Gentianeæ.

Cohort VIII.—Polemoniales.

110. Polemoniaceæ.
111. Hydrophyllaceæ.
112. Boragineæ.
113. Convolvulaceæ.
114. Solanaceæ.

Cohort IX.—Personales.

115. Scrophularineæ.
116. Orobanchaceæ.
117. Lentibularieæ.
118. Columelliaceæ.
119. Gesneraceæ.
120. Bignoniaceæ.
121. Pedalineæ.
122. Acanthaceæ.

Cohort X.—Lamiales.

123. Myoporineæ.
124. Selagineæ.
125. Verbenaceæ.
126. Labiatæ.
127. Plantagineæ.

Monochlamydeæ.

Series I.—CURVEMBRYEÆ.

128. Nyctagineæ.
129. Illecebraceæ.
130. Amarantaceæ.
131. Chenopodiaceæ.
132. Phytolaccaceæ.
133. Batideæ.
134. Polygonaceæ.

Series II.—MULTIOVULATÆ AQUATICÆ.

135. Podostemaceæ.

Series III.—MULTIOVULATÆ TERRESTRES.

136. Nepenthaceæ.
137. Cytinaceæ.
138. Aristolochiaceæ.

Series IV.—MICREMBRYEÆ.

139. Piperaceæ.
140. Chloranthaceæ.
141. Myristiceæ.
142. Monimiaceæ.

Series V.—DAPHNALES.

143. Laurineæ.
144. Proteaceæ.

Series V.—DAPHNALES.

145. Thymelæaceæ.
146. Penæaceæ.
147. Elæagnaceæ.

Series VI.—ACHLAMYDOSPOREÆ.

148. Loranthaceæ.
149. Santalaceæ.
150. Balanophoreæ.

Series VII.—UNISEXUALES.

151. Euphorbiaceæ.
152. Balanopseæ.
153. Urticaceæ.
154. Platanaceæ.
155. Leitnerieæ.
156. Juglandeæ.
157. Myricaceæ.
158. Casuarineæ.
159. Cupuliferæ.

Series VIII.—ORDINES ANOMALI.

160. Salicineæ.
161. Lacistemaceæ.
162. Empetraceæ.
163. Ceratophylleæ.

Gymnospermeæ.

164. Gnetaceæ.
165. Coniferæ.
166. Cycadaceæ.

MONOCOTYLEDONES.

SERIES I.—MICROSPERMÆ.

167. Hydrocharideæ.
168. Burmanniaceæ.
169. Orchideæ.

SERIES II.—EPIGYNÆ.

170. Scitamineæ.
171. Bromeliaceæ.
172. Hæmodoraceæ.
173. Irideæ.
174. Amaryllideæ.
175. Taccaceæ.
176. Dioscoreaceæ.

SERIES III.—CORONARIEÆ.

177. Roxburghiaceæ.
178. Liliaceæ.
179. Pontederiaceæ.
180. Philydraceæ.
181. Xyrideæ.
182. Mayaceæ.
183. Commelinaceæ.
184. Rapateaceæ.

SERIES IV.—CALYCINÆ.

185. Flagellarieæ.
186. Juncaceæ.
187. Palmæ.

SERIES V.—NUDIFLORÆ.

188. Pandaneæ.
189. Cyclanthaceæ.
190. Typhaceæ.
191. Aroideæ.
192. Lemnaceæ.

SERIES VI.—APOCARPÆ.

193. Triurideæ.
194. Alismaceæ.
195. Naiadaceæ.

SERIES VII.—GLUMACEÆ.

196. Eriocauleæ.
197. Centrolepideæ.
198. Restiaceæ.
199. Cyperaceæ.
200. Gramineæ.

CRYPTOGAMÆ.

[From Luerssen: MEDICINISCH-PHARMACEUTISCHE BOTANIK.]

CLASS I.—LYCOPODINÆ.

201. Selaginellæ.
202. Isoëtaceæ.
203. Lycopodiaceæ.

CLASS II.—EQUISETINÆ.

204. Equisetaceæ.

CLASS III.—FILICINÆ.

205. Rhizocarpeæ.
206. Ophioglossaceæ.
207. Marattiaceæ.
208. Filices.

CLASS IV.—MUSCI.

209. Stegocarpæ.
210. Cleistocarpæ.
211. Sphagna.
212. Schizocarpæ.

CLASS V.—HEPATICÆ.

213. Jungermanniaceæ.
214. Marchantiaceæ.
215. Anthoceroteæ.
216. Ricciaceæ.

CLASS VI.—CARPOSPOREÆ.

217. Basidiomycetes.
218. Ascomycetes.
219. Florideæ.
220. Coleochaeteæ.

CLASS VII.—OOSPOREÆ.

221. Fucoideæ.
222. Characeæ.
223. Œdogonieæ.
224. Coeloblasteæ.
225. Sphæropleeæ.
226. Coenobieæ.

CLASS VIII.—ZYGOSPOREÆ.

227. Zygomycetes.
228. Conjugatæ.
229. Myxomycetes.
230. Zoosporeæ.

CLASS IX.—PROTOPHYTA.

231. Saccharomycetes.
232. Schizomycetes.
233. Cyanophyceæ (Phycochromaceæ).
234. Chlorophyllophyceæ.

III.—PRODUCTS OF FERMENTATION AND DISTILLATION.

(Not subdivided.)

IV.—INORGANIC PRODUCTS.

[From Roscoe & Schorlemmer: TREATISE ON CHEMISTRY.]

NON-METALLIC ELEMENTS.

MONADS:

I.	—Hydrogen	H.
II.	—Chlorine	Cl.
III.	—Bromine	Br.
IV.	—Iodine	I.
V.	—Fluorine	F.

DYADS:

VI.	—Oxygen	O.
VII.	—Sulphur	S.
VIII.	—Selenium	Se.
IX.	—Tellurium	Te.

TRIADS:

X.	—Nitrogen	N.
XI.	—Phosphorus	P.
XII.	—Arsenic	As.

TETRADS:

XIII.	—Carbon	C.
XIV.	—Silicon	Si.
XV.	—Boron	B.

COPPER GROUP:

XXX.	—Copper	Cu.
XXXI.	—Silver	Ag.
XXXII.	—Mercury	Hg.

CERIUM GROUP:

XXXIII.	—Yttrium	Y.
XXXIV.	—Lanthanum	La.
XXXV.	—Cerium	Ce.
XXXVI.	—Didymium	DI.
XXXVII.	—Erbium	Er.

ALUMINIUM GROUP:

XXXVIII.	—Aluminium	Al.
XXXIX.	—Indium	In.
XL.	—Gallium	Ga.

IRON GROUP:

XLI.	—Manganese	Mn.
XLII.	—Iron	Fe.
XLII.	—Nickel	Ni.
XLIV.	—Cobalt	Co.

CHROMIUM GROUP:

XLV.	—Chromium	Cr.

METALLIC ELEMENTS.

METALS OF THE ALKALIES:

XVI.	—Potassium	K.
XVII.	—Sodium	Na.
XVIII.	—Lithium	Li.
XIX.	—Rubidium	Rb.
XX.	—Cæsium	Cs.

METALS OF THE ALKALINE EARTHS:

XXI.	—Calcium	Ca.
XXII.	—Strontium	Sr.
XXIII.	—Barium	Ba.

MAGNESIUM GROUP:

XXIV.	—Beryllium	Be.
XXV.	—Magnesium	Mg.
XXVI.	—Zinc	Zn.
XXVII.	—Cadmium	Cd.

LEAD GROUP:

XXVIII.	—Lead	Ph.
XXIX.	—Thallium	Th.
XLVI.	—Molybdenum	Mo.
XLVII.	—Tungsten	W.
XLVIII.	—Uranium	U.

TIN GROUP:

XLIX.	—Tin	Sn.
L.	—Zirconium	Zr.
LI.	—Thorium	Th.

ANTIMONY GROUP:

LII.	—Vanadium	V.
LIII.	—Antimony	Sb.
LIV.	—Bismuth	Bi.
LV.	—Tantalum	Ta.
LVI.	—Niobium	Nb.

GOLD GROUP:

LVII.	—Gold	Au.
LVIII.	—Platinum	Pt.
LIX.	—Ruthenium	Ru.
LX.	—Rhodium	Rh.
LXI.	—Palladium	Pd.
LXII.	—Iridium	Ir.
LXIII.	—Osmium	Os.

ALPHABETICAL INDEX TO CLASSIFICATION.

Name.	Symbol.
Acanthaceæ	122
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Alismaceæ	194
Aluminium	XXXVIII
Amarantaceæ	130
Amaryllideæ	174
Ampelideæ	50
Amphibia	D.
Anacardiaceæ	53
Annelida	L.
Anonaceæ	5
Anthoceroteæ	215
Antimony	LIII
Apocynaceæ	106
Araliaceæ	81
Arsenic	XII
Aristolochiaceæ	138
Aroideæ	191
Asclepiadeæ	107
Ascomycetes	218
Aves	B.
Balanopseæ	152
Balanophoreæ	150
Barium	XXIII
Basidiomycetes	217
Begoniaceæ	76
Berberideæ	7
Beryllium	XXIV
Bignoniaceæ	120
Bismuth	LIV
Bixineæ	17
Boragineæ	112
Boron	XV
Bromeliaceæ	171
Bromine	III
Bruniaceæ	63
Burmanniaceæ	168
Burseraceæ	42
Cacteæ	78
Cadmium	XXVII
Cæsium	XX
Calcium	XXI
Calycanthaceæ	3
Calycereæ	87
Campanulaceæ	91
Canellaceæ	16
Capparideæ	12
Caprifoliaceæ	83
Carbon	XIII
Carnivora	Ai
Caryophylleæ	22
Casuarineæ	158
Celastrineæ	47
Centrolepideæ	197
Cephalopoda	F.
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Chailletiaceæ	44
Characeæ	222
Chenopodiaceæ	131
Chlænaceæ	30
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Chlorine	11
Chlorophyllophyceæ	234
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Cistineæ	14
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Cœloblasteæ	224
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Coleochæteæ	220
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Combretaceæ	66
Commelinaceæ	183
Compositæ	88
Coniferæ	185
Conjugatæ	228
Connaraceæ	56
Convolvulaceæ	113
Copper	XXX
Coriarieæ	54
Cornaceæ	82
Crassulaceæ	60
Cruciferæ	11
Crustacea	K.
Cucurbitaceæ	75
Cupuliferæ	159
Cyanophyceæ	233
Cycadaceæ	166
Cyclanthaceæ	189
Cyperaceæ	199
Cytinaceæ	137
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Datisceæ	77
Diapensiaceæ	96
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Dilleniaceæ	2
Dioscoreæ	176
Dipsaceæ	86
Dipterocarpeæ	29
Droseraceæ	61
Ebenaceæ	102
Elatineæ	25
Elaeagnaceæ	147
Empetraceæ	162
Epacrideæ	95
Equisetaceæ	204
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Name.	Symbol.	Name.	Symbol.
Ericaceæ	93	Manganese	XLI
Eriocauleæ	196	Marattiaceæ	207
Euphorbiaceæ	151	Marchantiaceæ	214
Ficoideæ	79	Mayaceæ	182
Filices	208	Melastomaceæ	68
Flagellarieæ	185	Meliaceæ	43
Florideæ	219	Menispermaceæ	6
Fluorine	V	Mercury	XXXII
Frankeniaceæ	21	Molybdenum	XLVI
Fucoideæ	220	Monimiaceæ	142
Gallium	XL	Monotropeæ	94
Gasteropoda	G.	Moringeæ	55
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Geraniaceæ	38	Myrsineæ	100
Gesneraceæ	119	Myricaceæ	157
Gnetaceæ	164	Myristiceæ	141
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Goodenovieæ	90	Myxomycetes	229
Gramineæ	200	Naiadaceæ	195
Guttiferæ	27	Nepenthaceæ	136
Hamamelideæ	62	Nickel	XLIII
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Hymenoptera	I iii	Oleaceæ	104
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Ilicineæ	46	Ophioglossaceæ	206
Illecebraceæ	129	Orchideæ	169
Indium	XXXIX	Orobanchaceæ	116
Insecta	I.	Osmium	LXIII
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Irideæ	173	Palladium	LXI
Iridium	LXII	Palmæ	187
Iron	XLII	Pandaneæ	188
Isoëtaceæ	202	Papaveraceæ	10
Juglandeæ	156	Passifloræ	74
Juncaceæ	186	Pedalineæ	121
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CATALOGUE OF SPECIMENS IN THE MATERIA MEDICA COLLECTION OF THE UNITED STATES NATIONAL MUSEUM, DECEMBER 1, 1884.

EXPLANATIONS.

Letters (A, B & C) refer to classes of animal products, according to the preceding classification.

Arabic numerals refer to botanical orders.

The asterisk (*) indicates those specimens classed under "products of fermentation and distillation."

Roman numerals refer to the classification of chemical substances.

The abbreviation M. F. indicates that the specimen may be found in the section illustrative of "medicinal forms."

The specimens in the collection are arranged in the cases according to the preceding classification, beginning immediately after "medicinal forms," and continuing in regular order from left to right. The first specimen in each *class* is indicated by the appropriate symbol of the class, and also each *natural order* by its name and number.

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Scilla (*Urginea Scilla*). SQUILL. Bulb; cut; fl. ext 178
Scillæ acetum .... M. F.
SCAMMONY (*Convolvulus Scammonium*) 113
Schinus terebinthifolia. Aroeira. Bark 53
Scoparius (*Cytisus scoparius*) 57
Scozonera 88
Scutellaria lateriflora. SCULLCAP. Herb; pow'd; fl. ext 126

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Secua (*Feuillea scandens.*) 75
Semecarpus Anacardium. ORIENTAL CASHEWNUT 53
Senecio aureus. LIFE ROOT. Fl. ext 88
Senecio cyanurus. Leaves 88
SENEGA (*Polygala Senega*) 20
Senna. Alexandria 1st; 2d; cut; gr'd; pow'd; East Indian; Tinnevelly; pow'd; fl. ext.; Fruit 57
Sepia officinalis. CUTTLE-FISH. Shell .... F.
SERPENTARIA (*Aristolochia serpentaria*) 138
Sesamum indicum. BENNE. "Lucknow." "Gingelly seed" 200
Sesamum indicum. Oil. BENNE OIL 200
Sevum. SUET .... A III.
Shan-shi-che (*Gardenia florida*) 84
Shorea robusta. Resin 29
Sida retusa. Stems 31
Sienna. Italian, raw XXXVIII
Siliqua dulcis. ST. JOHN'S BREAD. Fruit 57
Silphium gummiferum. Fl. ext 88
Simaba cedron. Seed; fl. ext 40
Simaruba officinalis. SIMARUBA. Bark; gr'd 40
Sinapis alba. WHITE MUSTARD. 11
Sinapis nigra. Seed, California; do., German; ground; oil; vol. oil 11
Sindora Riedelliana. Bark 57
Sinopsis ramosa. Seed 11
Sisymbrium Iris. Seed 11
SMALT XLIV
Smilax China. CHINA ROOT. Root; pow'd 178
Smilax Japecanga. JAPECANGA. Rhiz 178
Smilax Sarsaparilla. Fruit 178
SOAPSTONE. Pow'd XXV
Sodii bicarbonas XVII
Sodii boras. Cryst.; pow'd XVII
Sodii chloridum. ROCK SALT; SEA SALT XVII
Sodii silicas XVII
Sodii sulphas. Crystals pow'd XVII
Solanum dulcamara. BITTER-SWEET. Stems; cut; fl. ext.; Root bark 114
Solanum indicum. Stems 114
Solanum Jacquini. Fruit 114
Solanum nigrum. Leaves; Herb 114
Solanum oleraceum. Stems 114
Solanum paniculatum. JURUBEBA. Fruit; Root 114
Solanum trilobatum. Stems 114
Solidago odora. GOLDEN-ROD. Herb; Flowers 88
Solidago montana. Herb 88
Sorghum vulgare. Seed 200
Soymida febrifuga. ROHUN TREE. Bark 43
Sparadrapa .... M. F.
Species aromatica 127
Species pectoralis .... M. F.
SPERM OIL .... A II.
Spermacoce hispida. Herb 84
Sphæranthus indicus. Flowers 88
Spigelia marilandica. PINK-ROOT. Root; do., washed; crushed; pow'd; fl. ext. 108
Spiræa tomentosa. HARDHACK. Root; fl. ext.; Herb 58
Spiritus lavendulæ comp .... M. F.

SPRUCE GUM (*Abies nigra*). Extra; ord 165
SPUNK 217
Stachys albicaulis. Root 126
Staphisagria (*Delphinum staphisagria*) 1
Statice braziliensis. Root; fl. ext 98
Statice Limonium. MARSH ROSEMARY. Root; herb; pow'd; fl. ext 98
Stellaria media. Herb 22
Stearin .... A ii.
Sterculia urens. Gum 32
STICK LAC (*Ficus* sp) .... I ii.
Stillingia sylvatica. Root; crushed; fl. ext; comp. fl. ext 151
Stramonium (*Datura stramonium*) 114
Strychniæ sulphas. Pills (gr. $\frac{1}{240}$); do. (gr. $\frac{1}{100}$); do. comp 108
Strychnos (?) *atherstonii.* Bark 108
Strychnos Gautheriana (HOANGNAN BARK) 108
Strychnos Ignatia. Seeds; pow'd 108
Strychnos Nux vomica. Seeds; gr'd; pow'd; tinct.; fl. ext.; pills 108
Strychnos Nux vomica. Bark. FALSE ANGOSTURA BARK 108
Strychnos potatorum. Seeds. CLEARING NUT (India) 108
Strychnos pseudo-quina. Root 108
Strychnos toxifera. WOORARI. Drug; do. (Guiana); do. (Venezuela) 108
Stylosanthes elatior. Herb; fl. ext 57
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Succinum. Resin; oil, crude; do., rect 165
Succus conii .... M. F.
Sulphur. BRIMSTONE. Roll sulphur; precip.; sublim.; *lotum; vivum* VII
Sumbul (*Ferula Sumbul*) 80
Summitates sabinæ. SAVIN TOPS .... M. F.
Suppositoria. Opium c. Tannic acid .... M. F.
SWEET PEPPER (*Capsicum tetragonum* var) 114
Swictenia senegalensis. Bark; fl. ext 43
Symphytum officinale. COMFREY. Root; fl. ext 112
Symplocos cratægoides. Bark 103
Syrupus fuscus. MOLASSES. W. Indian; Golden Sirup 200
Syrupus rhei .... M. F.
Syzigium jambolanum. Bark 61
Tabacum (*Nicotiana tabacum*). Oil 114
Tacamahaca. Gum 42
Tamarindus indica. Fruit; Bark 57
Tamarindus orientalis. Bark 57
Tanacetum vulgare. TANSY. Herb; pow'd; oil 88
Tapioca 151
Taraxacum Dens-leonis. DANDELION. Root; pow'd; fl. ext.; elix.; elix. co 88
Tectona grandis. TEAK. Fruit 125
Tephrosia purpurea. Herb 57
Terebinthina. WHITE TURPENTINE 165
Terebinthina argentoriensis. STRASSBURG T 165
Terebinthina canadensis. BALSAM OF FIR 165
Terebinthina chia. CHIAN T 53
Terebinthina laricina. VENICE T 165
Terebinthinæ oleum. OIL OF T 165
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Terminalia chebula. Fruit 66
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Testa præparata. PREPARED OYSTER SHELL .... H.

Tetranthera Roxburghii. Bark 143
Theobroma Cacao. CHOCOLATE TREE. Seed, Bahia; do., Maracaibo; do., Trinidad: oil 32
Thespesia populnea. Fruit 31
Thuja occidentalis. *Arbor vitæ.* Fl. ext 165
Thymol 126
Thymus vulgaris. THYME. Oil 126
Tiardium indium. Herb 112
Tilia argentea. Seed 33
Tilia sp. Herb 33
Tilia sylvestris. Herb 33
Tillandsia recurvata. Plant 171
Tinctura lobeliæ ætherea .... M. F.
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Tinospora cordifolia. GULANCHA. Stems; extract 6
Toddalia aculeata. Root 39
To-yak (Pleurogyne rotata) 109
Tonka (Dipterix odorata) 57
Tragacantha. Aleppo, extra; do., ord.; select No. 2 and 3; flake; Turkey flake No. 1; do., No. 2; do., brown; do., round sorts; hog; sorts; ribbon; vermicelli; pow'd; Bombay 57
Tragia connabina. Root and stems 151
Trapa bispinosa. SINGHARA. Starch 64
Trehala. Cocoons Ii
Trianospermia ficifolia. Stems 75
Tribulus alatus. Fruit 37
Trichodesma indicum. Herb 112
Trichosanthes cucumerina. Stems 75
Tricostemna lanceolata. Cut herb 126
Trifolium pratense. CLOVER. Flower-heads; fl. ext 57
Trigonella Fœnum-græcum. Seed 57
Trillium pendulum. BETH ROOT. Rhiz.; crushed 178
Triosteum perfoliatum. FEVER ROOT. Root; pow'd 83
Triticum repens. COUCH GRASS. Root; fl. ext 200
Trituratio hydrarg. iodid. rub .... M. F.
Trochisci potass. chlor .... M. F.
Turnera aphrodisiaca. DAMIANA. Leaves; gr'd; fl. ext 73
TURPENTINE 165
Tylophora asthmatica. Leaves 104
Typha latifolia. CAT-TAIL FLAG. Rhiz 190
Ulmus fulva. SLIPPERY ELM. Bark; gr'd; pow'd 153
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UMBER XXXVIII
Urechites suberecta. JAMAICA NIGHTSHADE. Herb; fl. ext 106
Urginea indica. Bulb 178
Urtica dioica. NETTLE. Herb; Flowers 153
Urtica mexicana. Stems 153
Ustilago maydis. CORN SMUT. Fungus; fl. ext 217
Uvæ passæ. RAISINS 50
Uvæ passæ minores. CURRANTS 50
Uva ursi. BEARBERRY (*Arctostaphilos Uva-Ursi*) 93
Vaccinum myrtillus. WHORTLEBERRY. Fruit 92
Valeriana officinalis. Root, English ("Baker's Hartshorn"); gr'd; pow'd; German; pow'd; American; pow'd; fl. ext.; oil, and pearls of 85
Vallesia hypoglauca. Bark. AMARGOSA BARK 106

Vanilla planifolia. Fruit, Mexican 172
Vanillin .... *
Vaseline 178
Vateria indica. Resin 29
Veratrum album. WHITE HELLEBORE. Rhiz.; pow'd 178
Veratrum Sabadilla. CEVADILLA. Seed; pow'd; Seed (Venezuela) 178
Veratrum viride. AMERICAN HELLEBORE. Crushed; fl. ext 178
Verbascum Thapsus. MULLEIN. Leaves; Flowers 115
Verbena officinalis. Herb; fl. ext 125
Vernonia anthelmintica. Flowers 88
Veronica officinalis. SPEEDWELL. Herb 115
Viburnum opulus. Bark. CRAMP BARK; fl. ext 83
Viburnum prunifolium. BLACK HAW. Bark; gr'd; fl. ext 83
Vinum antimonii .... M. F.
Viola odorata. SWEET SCENTED VIOLET. Flowers (India); do. (Chili) 15
Viola pedata. VIOLET. Rhiz 15
Viola repens. Rhiz 15
Viola tricolor. PANSY. Herb 15
Viscum album. MISTLETOE. Branches; fl. ext 148
Vitex taruma. Bark. TARUMA BARK 125
Vitex trifolia. Fruit 125
Wahoo (*Euonymus purpurea*) 47
WAX. Bees (*Cera alba et flava*) .... I III
WAX. Bagberry, Myrtle (*Myrica cerifera*) 157
WAX. Japan (*Rhus succedaneum*) 53
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Weinmannia trichospermia. PALO SANTO. Wood 59
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WINE OF BEEF .... A iii
WINE OF BEEF AND IRON .... A iii
WINTER'S BARK (*Drimys Winteri*) 4
Withania coagulans. Fruit 114
Withania somnifera. Stems 114
Wrightii antidysenterica. Seed; Bark 106
Xanthium spinosum. Herb; pow'd; root 88
Xanthorrhiza apiifolia. Rhiz; pow'd 1
Xanthorrhoea hastilis. GUM ACAROID. *Xanthorrhœa hastilis*, etc 39
Xanthoxylum carolineanum. SOUTHERN PRICKLY ASH. Bark 39
Xanthoxylum fraxineum. NORTHERN PRICKLY ASH. Bark; gr'd; fl. ext.; Fruit; fl. ext 39
Xanthoxylum hastile. Bark 39
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Yerba buena (*Micromeria Douglassii*) 126
Yerba mate (*Ilex paraguayensis*) 46
Yerba rheuma (*Frankenia grandiflora*) 21
Yerba santa (*Eriodyction glutinosum*) 111
Zaffre XLIV
Zedoaria (*Curcuma Zedoaria*) 170
Zinci carbonas imp. CALAMINE L
Zinci phosphas. Pills (gr. $\frac{1}{6}$) L
Zinci sulphas. Crystals L
Zingiber officinale. Rhiz., African; gr'd; pow'd; Cochin, scraped; East Indian; Jamaica, unbleached; gr'd; pow'd; fl. ext.; tinct.; Oleoresin 170
Zizea aurea. Herb 80
Zizyphus jujuba. Bark; Fruit 49
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SMITHSONIAN INSTITUTION.

UNITED STATES NATIONAL MUSEUM.

No. 33.

NOTES ON THE PREPARATION OF ROUGH SKELETONS.

BY FREDERIC A. LUCAS.

These directions for preparing rough skeletons have been divided into sections, in order that the collector might turn at once to the portion bearing directly on the subject in hand. The general directions for mammals, however, apply with more or less force to all skeletons.

The extent to which these instructions can be followed will of necessity depend largely on circumstances. It is not to be expected that a collector working in the field would use the same time and care as one residing on the spot or located for some time at one place, but as one well prepared, *perfect* skeleton is worth more than half a dozen mutilated specimens, a little time spent in the work of roughing out and packing will be well repaid. If anything *must* be slighted, let it be the labeling, as it is far more important to have the skeleton itself than to have the facts pertaining to it.

IDENTIFICATION OF SPECIMENS.

It is, of course, extremely important to know the correct name of every skeleton, and whenever possible this should be attached to the specimen.

When the animal is unknown, either the skin, roughly taken off, should be kept, or else another specimen made into a skin, in order that it may serve as a means of identifying the skeleton.

LABELS.

Use good *manila* labels, as thin paper is so apt to be torn or defaced. A very good plan is to cut Roman numbers on a bit of wood and let these refer to entries in a note-book.

SELECTION OF SPECIMENS—BREAKAGES.

Where time allows, select a series of skeletons of different ages; but where only one skeleton can be prepared, choose a fully grown, adult animal, as free as possible from breakages. If an animal is shot or trapped it is impossible to avoid breaking some bones, and such must be allowed to pass, but where it has been beaten to death, fracturing the skull and limb bones generally, the animal had better be thrown away at once.

If the skull alone is broken, select if possible another of the same size and send *both* with the body. When convenient send with a broken leg or wing another of the same size, but on no account throw away the fractured limb.

TOOLS.

A knife and a pair of scissors are all that are absolutely necessary, but if these can be supplemented by one or two steel scrapers, the work will be greatly facilitated.

"ROUGHING OUT." MAMMALS.

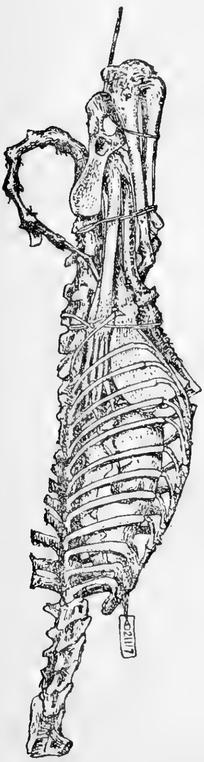

FIG. 1.—Skeleton of Fox ready for packing.

If an animal is rare, the skin should be very carefully taken off and preserved; otherwise, remove the skin roughly and disembowel the specimen, taking care not to cut into the breast-bone, especially the disk-shaped piece of cartilage in which it ends. Animals destined for skeletons should *on no account* be split up the breast as though they were being dressed for market.

Detach the legs from the body and remove the flesh, taking care in so doing not to remove the collar-bone or knee pan with the meat. In the cat family the collar bone is very small, and lies loose in the flesh between the shoulder-blade and front end of breast-bone. The collar-bone of weasels is very minute and difficult to find, while, on the other hand, climbing and burrowing animals usually have this bone well developed and uniting the shoulder-blade with the breast-bone.

Deer, antelope, bears, and seals have no collar-bone.

In small quadrupeds it will not be necessary to detach the legs, but, whenever convenience in roughing out or packing renders this needful, cut the collar-bone loose from the breast-bone and leave it fastened to the shoulder-blade.

The legs being finished, disjoint and clean the skull. Be careful in removing the eyes not to thrust

the point of the knife through the thin portion of the skull back of them, and in deer, antelope, or other ruminants take care not to break through the thin bone at the back end of the upper teeth. Also look out for any projections of bone so as not to cut them off.

Remove as much of the brain as possible with a scraper, bent wire, or small stick.

In cleaning the ribs take care not to cut the cartilages joining them to the breast bone, and, when the tail is reached, look for a few little bones projecting downwards from the first few vertebræ.

If time allows, soak the roughed-out skeleton in water for a day or two to extract the blood; at all events wash thoroughly and brush with a good stiff brush.

Fold the legs snugly along the body, or, if they have been detached, tie them together with the skull on the under side, as much as possible within the chest cavity; also turn down the tail and tie it upon itself.

Roll up in a bit of rag and fasten *securely* to one of the long bones any bones which may have been detached or any splinters from a broken bone.

Hang up to dry in the shade,* where it will escape dogs, cats, and rats.

Lastly, in case a small skeleton is likely to be some time on the road, give it a very thin coat of arsenical soap to preserve it from the attacks of Dermestes and other insects.

SPECIAL POINTS.

Embracing the upper part of the windpipe and connecting it with the base of the skull is a series of bones known as the hyoid apparatus. This should be carefully saved.

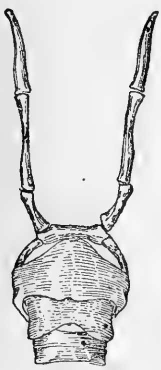

FIG. 2.—Tongue-bones or hyoid of a Dog.

FIG. 3.—Right shoulder-blade of a Rabbit, showing the backwardly-projecting process.

There are usually small bones, termed sesamoids, imbedded in the tendons, where they play over the under sides of the toes, and on this account the tendons should never be cut off close to the bone.

There are often one or two small bones on the back lower portion of the thigh-bone, and these should be left in place.

In preparing the skeletons of rabbits, particular attention should be

* In this the collector will necessarily be governed by circumstances, as in moist climates it may be needful to dry a specimen in the sun, or even by the aid of a fire, although this should be done only as a last resort.

given to the shoulder-blade, as this has a slender projection at the lower end which extends some distance backward.

The male organ of a great many quadrupeds, as in the raccoon, is provided with a bone. As it is difficult to say when this may or may not be present, it should always be looked for, and when found left attached to the hip-bones.

CETACEANS: PORPOISES, BLACKFISH, ETC.

Porpoise skeletons are very easily prepared, but one or two points, such as the slender cheek-bones, and the pelvic bones or rudimentary hind limbs, require special care.

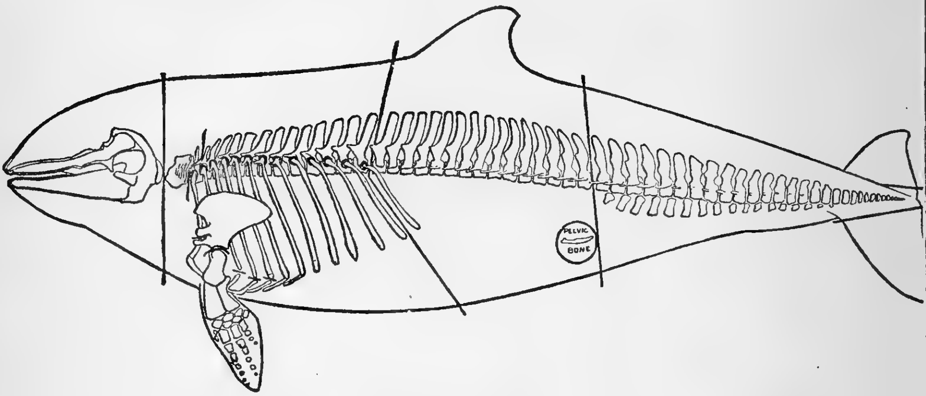

FIG. 4.—Skeleton of a Porpoise, the dotted lines showing where the cuts should be made in dividing the skeleton.

The pelvic bones are so small and so imbedded in the flesh that they are only too often thrown away. The accompanying cuts show their location and their average size in a specimen 7 or 8 feet long.

It often happens that the last rib lies loose in the flesh, with its upper end several inches from the backbone. This should always be looked for.

There are no bones in the *sides* of the tail or flukes nor in the back fin, and they can be cut off close to the body and thrown away.

The hyoid is largely developed in most cetaceans, and will be found firmly attached to the base of the skull.

FIG. 5.—Full-sized pelvis of a Porpoise (*Tursiops*).

BIRDS.

In preparing a bird for a skeleton a little more care must be used than is necessary with a quadruped, the bones being lighter and more easily cut or broken.

The wings terminate in very small, pointed bones, and there is a similar bone—corresponding to the thumb of mammals—hidden in a tuft of feathers on the bend of the wing.

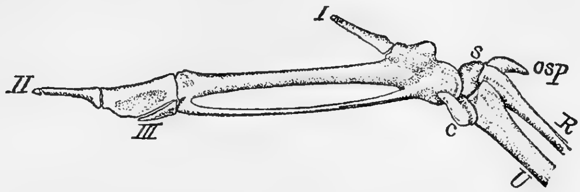

FIG. 6.—Portion of right wing of Great Horned Owl, seen from below. *R*, Radius; *U*, Ulna; *I*, *II*, *III*, First, second, and third fingers; *s*, Radiale; *c*, Ulnare; *osp*, Os prominens.

It is a good plan to leave this tuft untouched, as well as the outermost two or three wing feathers, so as to lessen the risk of removing any of these little bones with the skin.

Other parts requiring special attention are the slender points on the under side of the neck vertebræ, those projecting backward from the ribs, and the last bone of the tail.

It frequently occurs in birds that many of the tendons become ossified, as they do in the leg of a turkey. Look out for such on the under side of the neck, in the legs and wings, and along the sides of the back, and do not tear off the muscles as you would if preparing a skin.

Considerable flesh may be left on the neck and back and a *thin* coat of arsenical soap will serve to keep out the Dermestes which would otherwise attack these places.

The hyoid, or bones supporting the tongue and attached to the windpipe, should be saved, as should also the windpipe itself whenever, as in many ducks, it has bony structures developed in part of its length.

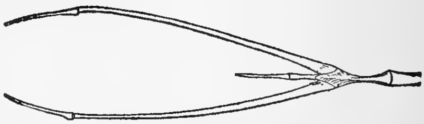

FIG. 7.—Tongue-bones or hyoid of a Great Blue Heron.

In many birds, and especially in birds of prey, there is a ring of bones surrounding the pupil of the eye. It is therefore best—unless you are an expert—not to remove the eyeball, but to simply puncture it to allow the escape of its fluid contents.

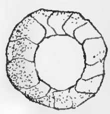

FIG. 8.—Eye-bones, sclerotals, of a Great Blue Heron.

Remove the brain carefully.

Wash and brush the skeleton if time allows, and in

making a bundle for packing, bend the neck backward, and fold the legs and wings closely alongside of the body.

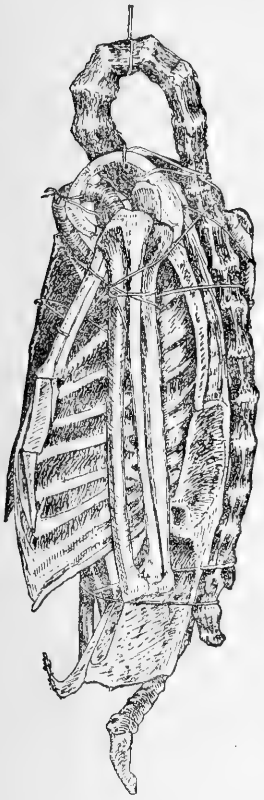

FIG. 9.—Skeleton of a bird rea y for packing.

SPECIAL POINTS.

Cormorants have a small bone attached to the back of the skull, and in Auks and many similar birds there is a small bone at the elbow.

Sometimes there is a little bone at the hinder angle of the lower jaw, so that it is a good rule not to trim up a bird's skull too closely.

TURTLES.

In order to rough out a turtle the under shell or plastron must be removed.

In sea turtles and a few others this can be cut loose by taking a little time to the operation, but in the more solidly-built tortoises and most fresh-water turtles it is necessary to saw through the plastron, following the line indicated in the accompanying diagram.

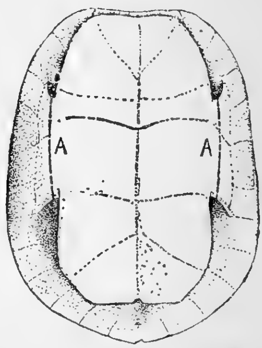

FIG. 10.—Shell of a Turtle (*Chrysemys marginata*). A A, where cuts should be made to remove the lower shell or plastron.

The interior of the body being exposed, it is a comparatively easy matter to cut away the flesh.

Beware, however, of cutting into any bones, as they are frequently soft in texture and easily damaged. Usually this can be done without disjointing any of the legs, and it is better, especially in small specimens, to leave them attached to the body.

SNAKES.

Snakes require very little care in their preparation after the skin has been removed, but in the larger serpents, such as boas and pythons, rudimentary hind legs are present and should be carefully preserved.

FIG. 11.—Limb of a Python (*P. molurus*), full size.

Externally the legs appear as two little claws situated on either side of the vent; internally they are slender bones, about an inch and a half in length, loosely attached to the ribs.

It is a comparatively easy matter to preserve both the skin and skeleton of any good-sized snake by exercising a little patience.

Do *not* try to skin through the mouth, but make a long cut on the under side and skin either way from it.

Coil up the skeleton and it will make a very compact bundle.

CROCODILES.

The breast-bone of crocodiles extends the entire length of the body, and although the hinder portion of it is not attached to the backbone, yet great care is necessary in disemboweling not to cut away any of the slender bones of which it is formed.

There are also cartilaginous projections on the ribs which should not be sliced off in roughing them out.

FISHES.

Fishes vary so much in their structure that it is a difficult matter to give any directions for preparing their skeletons that would be of much service. Almost invariably there are two rows of ribs present, and these extend backward for some distance.

Proceed slowly and carefully, as the edge of the scalpel will often give notice of some unsuspected bone.

Be especially careful about the head. There is a chain of bones encircling the eye, and the eyeball itself is often a bony cup.

Occasionally there are two or three bones attached to the back part of the hinder portion of the head, and the patch of flesh on the cheek is about all that can safely be removed.

Wash thoroughly, and when the skeleton is hung up to dry place bits of wood or other material between the gills so that the air may circulate freely and dry them rapidly.

PACKING.

First be sure that a skeleton, and especially a small one, is *thoroughly dry*. Otherwise it is apt to "sweat" and rot the ligaments.

In the case of a large skeleton this would do no harm, but as the bones of small animals are left attached to one another by their ligaments and are not wired together, any such separation causes serious injury.

If the specimen is the size of a deer, it will be necessary to disjoint the backbone just behind the ribs in order to make a compact bundle.

A moose or buffalo can be cut up still more by separating the leg-bones at each joint and making several sections of the backbone.

Occasionally it is necessary to reduce a skeleton to its smallest possible dimensions, and then, in addition to the above measures, the breast-bone must be separated from the ribs by cutting through the cartilage *just below the end of each rib*. The ribs can then be detached from the backbone, and thus dismantled a good-sized skeleton can be packed in a flour barrel. Barrels, by the way, are very good for packing purposes.

Boxes should be tight, so as to shut cut hungry dogs, and prevent entirely the attacks of rats and mice. I have frequently seen valuable skeletons ruined in a single night by the ravages of one or two rats.

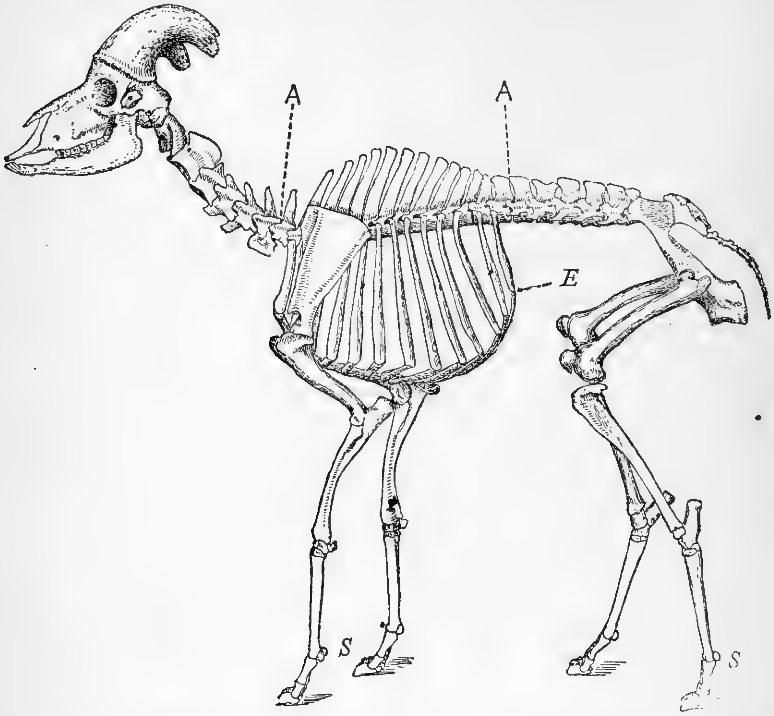

FIG. 12.—Skeleton of Mountain Sheep; AA, places where backbone may be disjointed; E, place where cut should be made to separate rib from breast-bone; S, sesamoids.

Care should also be taken not to leave boxes open over night while being packed, lest mice should make a nest in the packing material and be shut up with the specimens.

Straw or hay is the best packing material, but Spanish moss, shavings, "excelsior," or cocoa fiber will do. Usually but little is needed, the main point being to prevent the skeletons or loose bones from rattling about to the inevitable damage of the weaker portions.

Beware of sea-weed. No matter how dry it appears to be, it contains so much salt as to become wet when exposed to a moist atmosphere.

Never put alum on a skeleton nor soak any bones in a bath containing alum.

In hot, moist climates it is occasionally allowable to sprinkle a little salt on the bones of a large animal in order to keep the flesh from putrefying instead of drying up.

Small skeletons should on no account be salted, nor should large ones be boiled to remove the flesh.

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EXPLANATION OF PLATE I.

Fig. I represents the tracings taken while the heart was working under the influence of atropized blood.

Fig. II shows tracings obtained while the heart was under the influence of normal nutrient blood-mixture; it is also intended to illustrate the promptness and completeness with which the heart passed out from under the influence of atropia, as can be seen on the left-hand side of the figure, where part of the tracing taken under atropized blood is left on for the purpose of showing this.

The cumulative effect of this drug, therefore, seems almost insignificant enough to be entirely disregarded, so far, at least, as the heart is concerned.

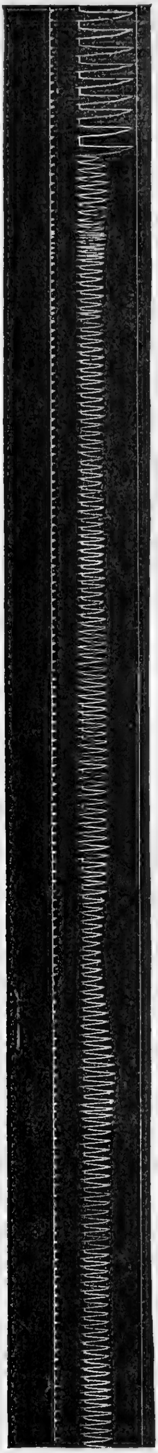


Fig. 2.

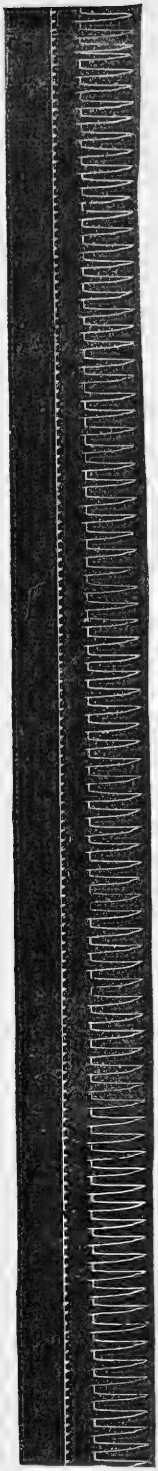


Fig. 1.

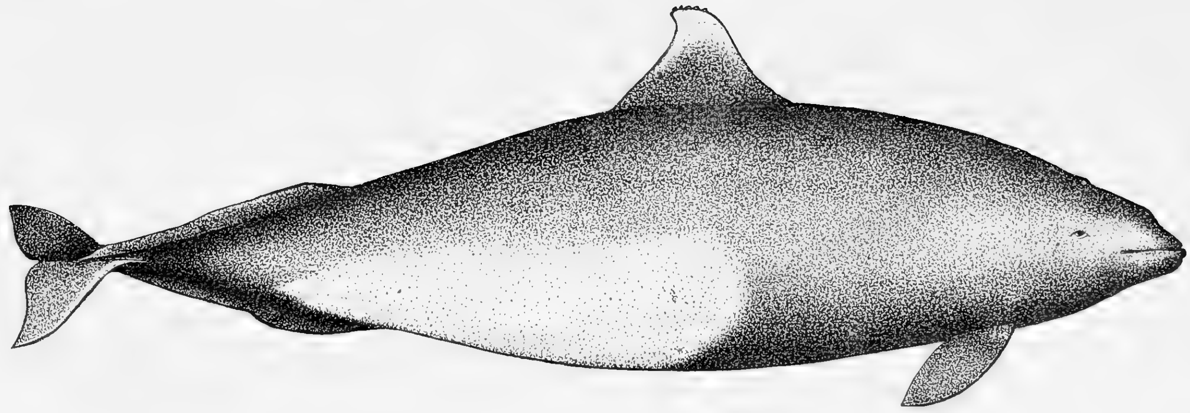
PULSATIONS OF TERRAPIN'S HEART.

EXPLANATION OF PLATE II.

(For description see pages 95–98.)

Phocœna dalli True. Side view.

The type of the species, taken at Adakh Island, Alaska, by Mr. W. H. Dall.



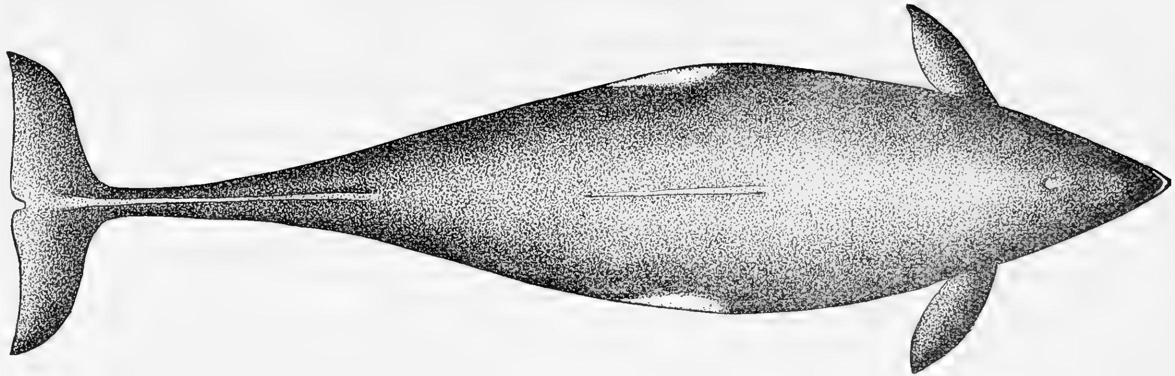
PHOCÆNA DALLI—SIDE VIEW.

EXPLANATION OF PLATE III.

(For description see pages 95–98.)

Phocœna dalli True. View from above.

PLATE III.

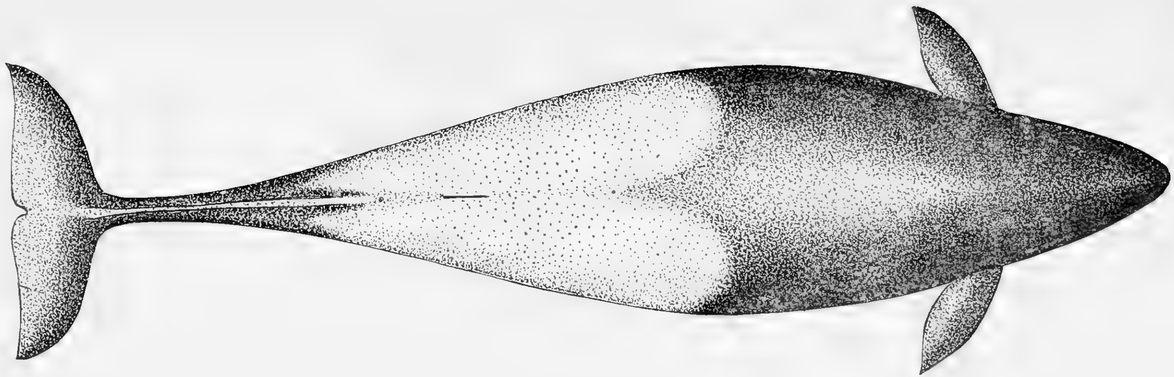


PHOCÆNA DALLI—VIEW FROM ABOVE.

EXPLANATION OF PLATE IV.

(For description see pages 95–98.)

Phocæna dalli True. View from below.

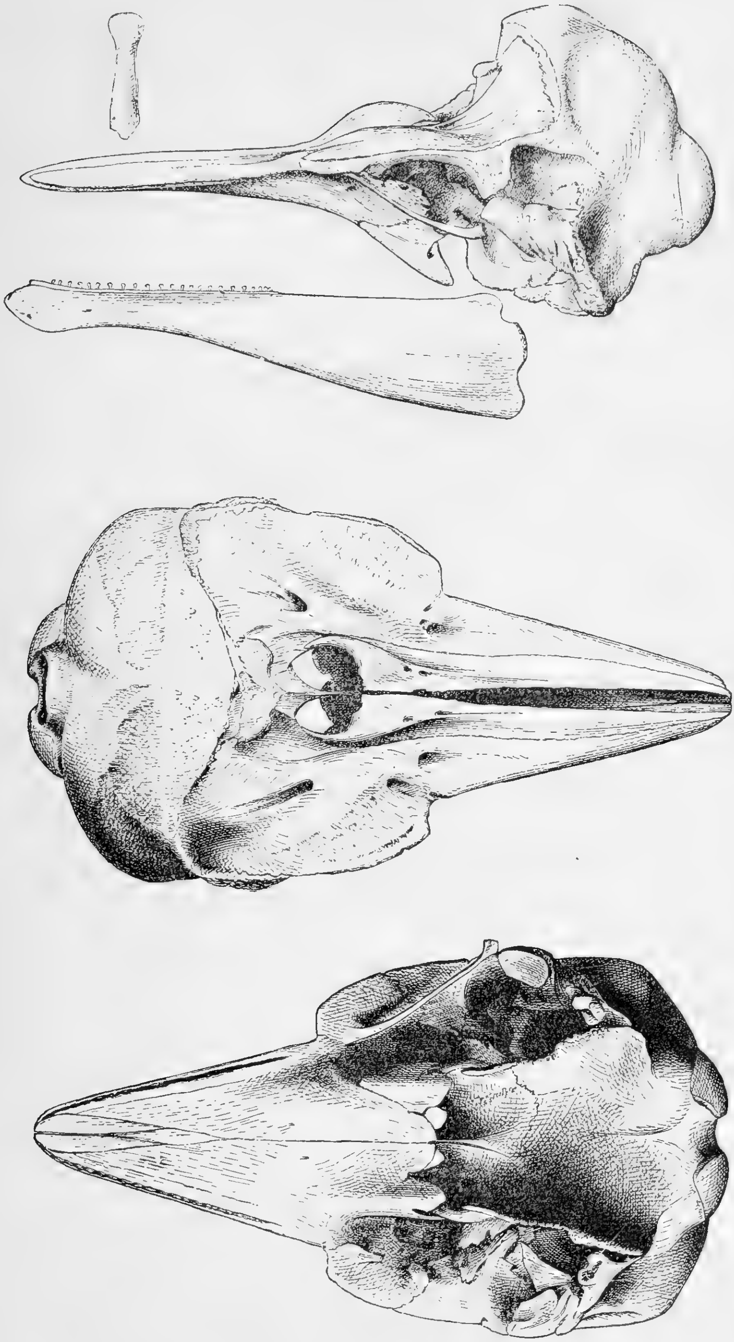


PHOCÆNA DALLI—VIEW FROM BELOW.

EXPLANATION OF PLATE V.

(For description see pages 95–98.)

Phocæna dalli True. Views of skull.



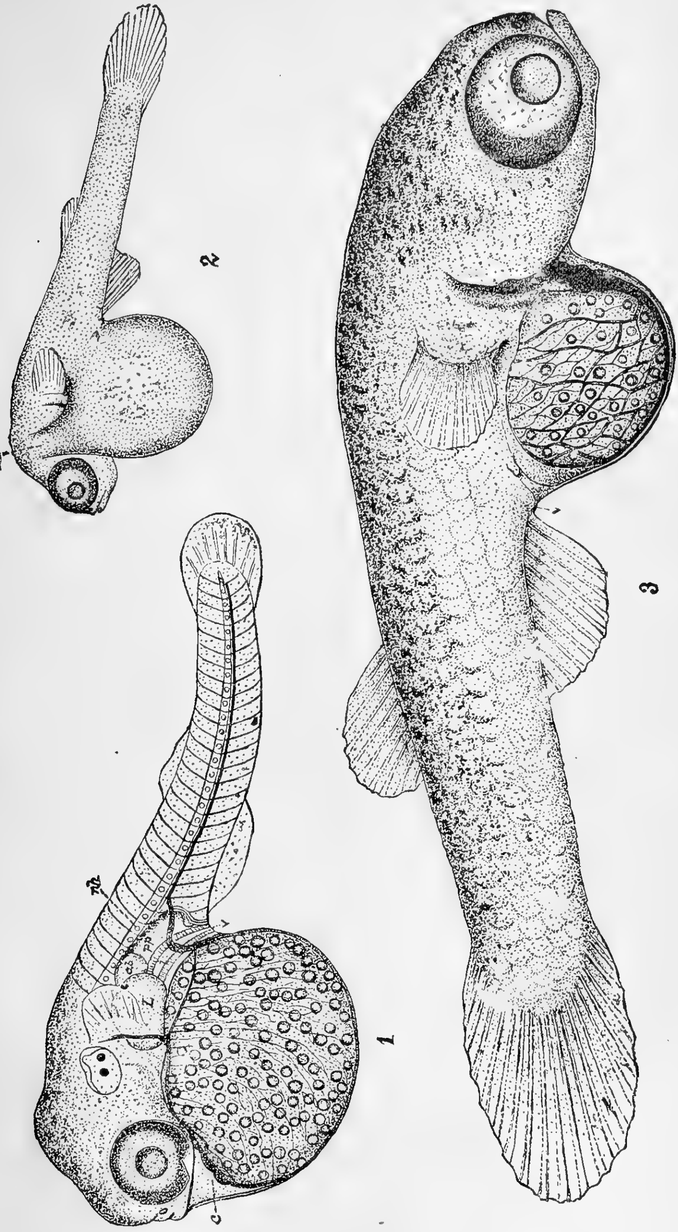
SKULL OF PHOCÆNA DALLI.

EXPLANATION OF PLATE VI.

FIG. 1.—Side view of fœtal *Gambusia* recently removed from the ovarian follicle. x 22.

FIG. 2.—Side view of a somewhat older embryo taken from the follicle and hardened in chromic acid. x 11.

FIG. 3.—Side view of a still older embryo, with the yelk-sac still apparent, taken from the follicle and figured while alive. x 22.



DEVELOPMENT OF GAMBUSIA PATRUELIS.

EXPLANATION OF PLATE VII.

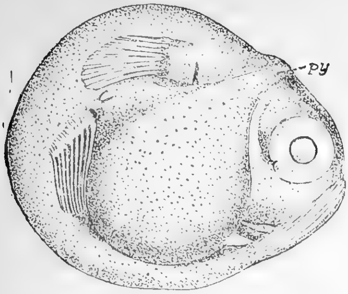
REFERENCES:—*a*, anal fin; *ab*, air-bladder; *al*, urinary vesicle; *au*, auditory vesicle; *ba*, bulbus aortæ; *c*, pericardiac cavity; *cs*, coraco-scapular cartilage; *f*, pecten; *i*, intestine; *L*, liver: *m*, muscular somites; *mb*, mid-brain; *Mk*, Meckel's cartilage; *n*, nasal pit; *o*, generative gland; *pn*, mesonephros: *pq*, palato-quadrate cartilage; *pp*, peritoneal cavity; *r*, muscles of the eye: *sc*, cavity between the viscera and yelk; *sv*, sinus venosus; *v*, vent or anus; *vv*, vitelline vessels; *ve*, ventricle: *Wd*, Wolffian or segmental duct; *y*, yelk; *yh*, yelk hypoblast or periblast.

FIG. 4.—Fœtus hardened, in its follicle to show the way in which it is coiled up. x 15.

FIG. 5.—Transverse section of an advanced embryo through the yelk-sac and body in the vicinity of the pectoral fins. x 29.

FIG. 6.—Longitudinal vertical section of an advanced embryo somewhat off of the median line. x 29.

FIG. 7.—Longitudinal vertical section of a similar embryo nearer the median line than the preceding, x 29.



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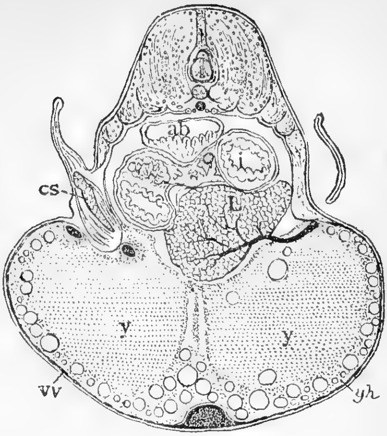

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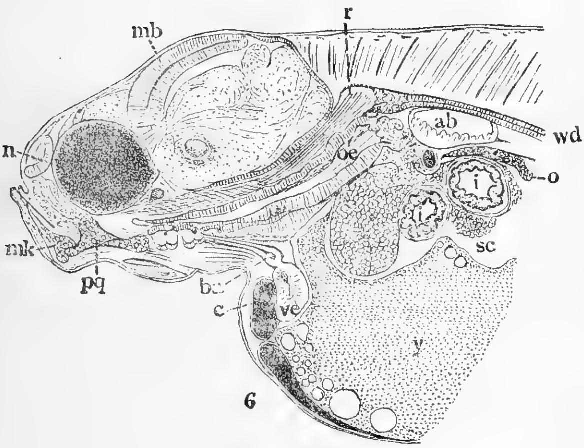

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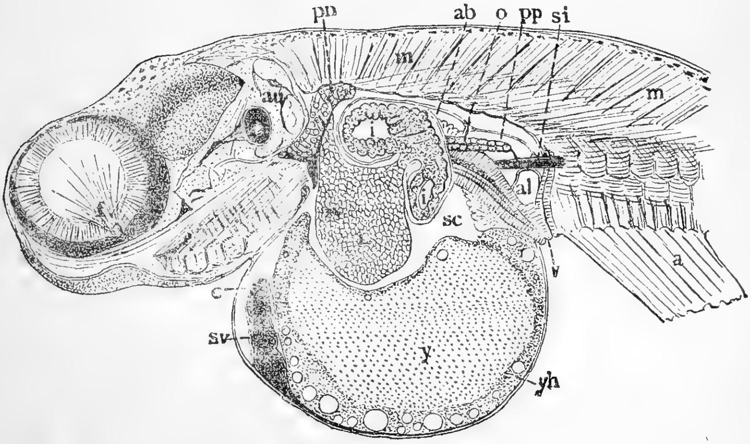

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DEVELOPMENT OF GAMBUSIA PATRUELIS.

EXPLANATION OF PLATE VIII.

REFERENCES: *ab*, air-bladder; *ao*, aorta; *au*, auricle; *ba*, bulbus aortæ; *ch*, chorda dorsalis; *ep*, epiblast of yelk-sac; *fm*, follicular membrane; *fv*, follicular vessel; *i*, intestine; *L*, liver; *mp*, follicular pore; *ms*, medulla spinalis; *pf*, muscular mass at base of pectoral; *sv*, sinus venous; *t*, pectoral in section; *vc*, venæ caudalis and cardinales; *ve*, ventricle; *Wd* Wolffian duct; *y*, yelk; *yhy*, yelk hypoblast or periblast.

FIG. 8.—Transverse section through the heart, showing its chambers. x 35.

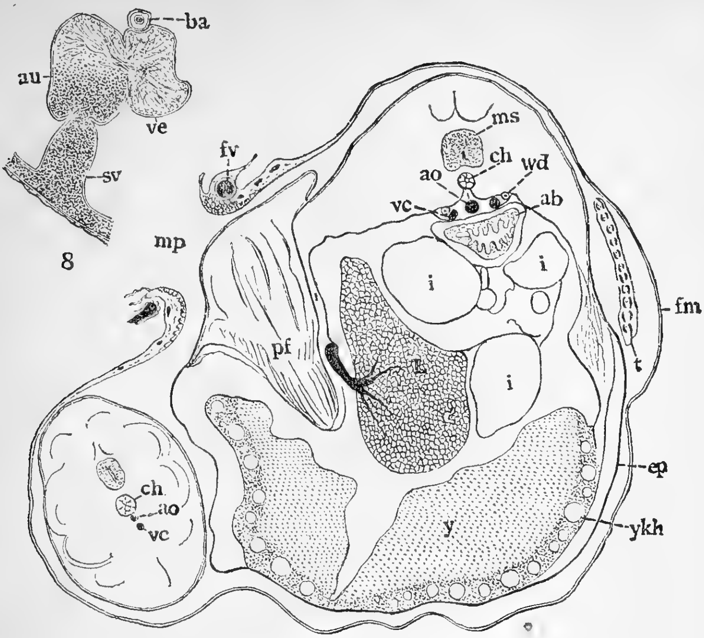
FIG 9.—Transverse section through a follicle containing an embryo, cutting through the plane of the follicular pore. x 32.

FIG. 10.—A follicle containing an embryo with two immature eggs attached near the follicular pore. x 15.

FIG. 11.—Ovary of *Gambusia*, showing the way in which the ripe ova are attached to the median vessel. x 3.

FIG. 12.—Follicular pore and adjacent parts of membrane of a follicle, showing the course of the vessels, from a transparent preparation in balsam. x 65.

PLATE VIII.



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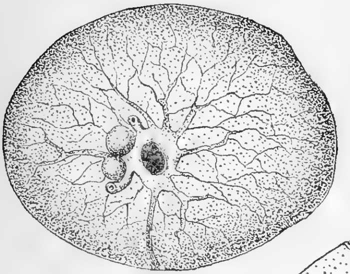

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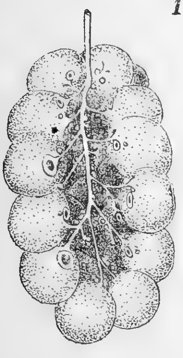

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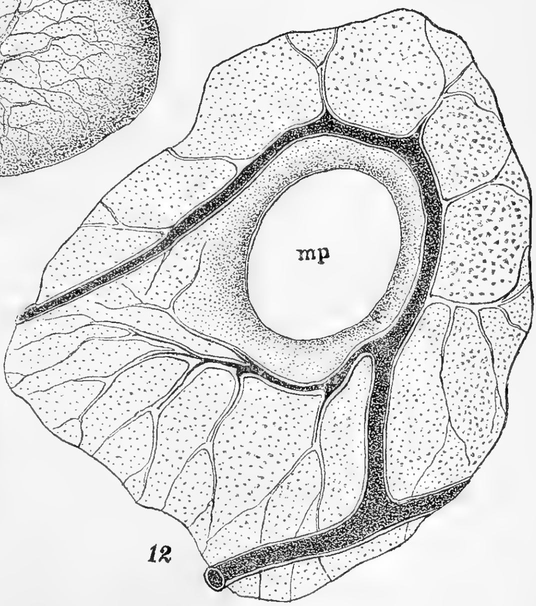

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DEVELOPMENT OF GAMBUSIA PATRUELIS.

EXPLANATION OF PLATE IX.

REFERENCES: *a*, anal fin; *ab'*, branchial artery; *b*, basicranial end of chorda; *bh*, branchial arch; *c*, cartilaginous axis of branchial filament; *ch*, chorda dorsalis; *e*, end organs or neuromasts on the cheeks; *hs*, hæmal cartilages; *l*, intervertebral ligaments; *ms*, medulla spinalis; *n*, nerves to neuromasts; *ns*, neural spines; *r*, rays; *rb*, rib; *sh*, membranous basis of vertebral centrum; *sp*, scale pouches; *u*, hæmal cartilage into which the urochord projects; *vr*, vertebral centra; *vt*, ventral fin.

FIG. 13.—Earliest embryo of *Gambusia* as it lies in the follicle. x 22.

FIG. 14.—Part of follicular membrane very much magnified. x 365.

FIG. 15.—Cross-section through the tail of an advanced embryo. x 35.

FIG. 16.—Longitudinal section through the anterior end of the incipient vertebral column of an advanced embryo. x 96.

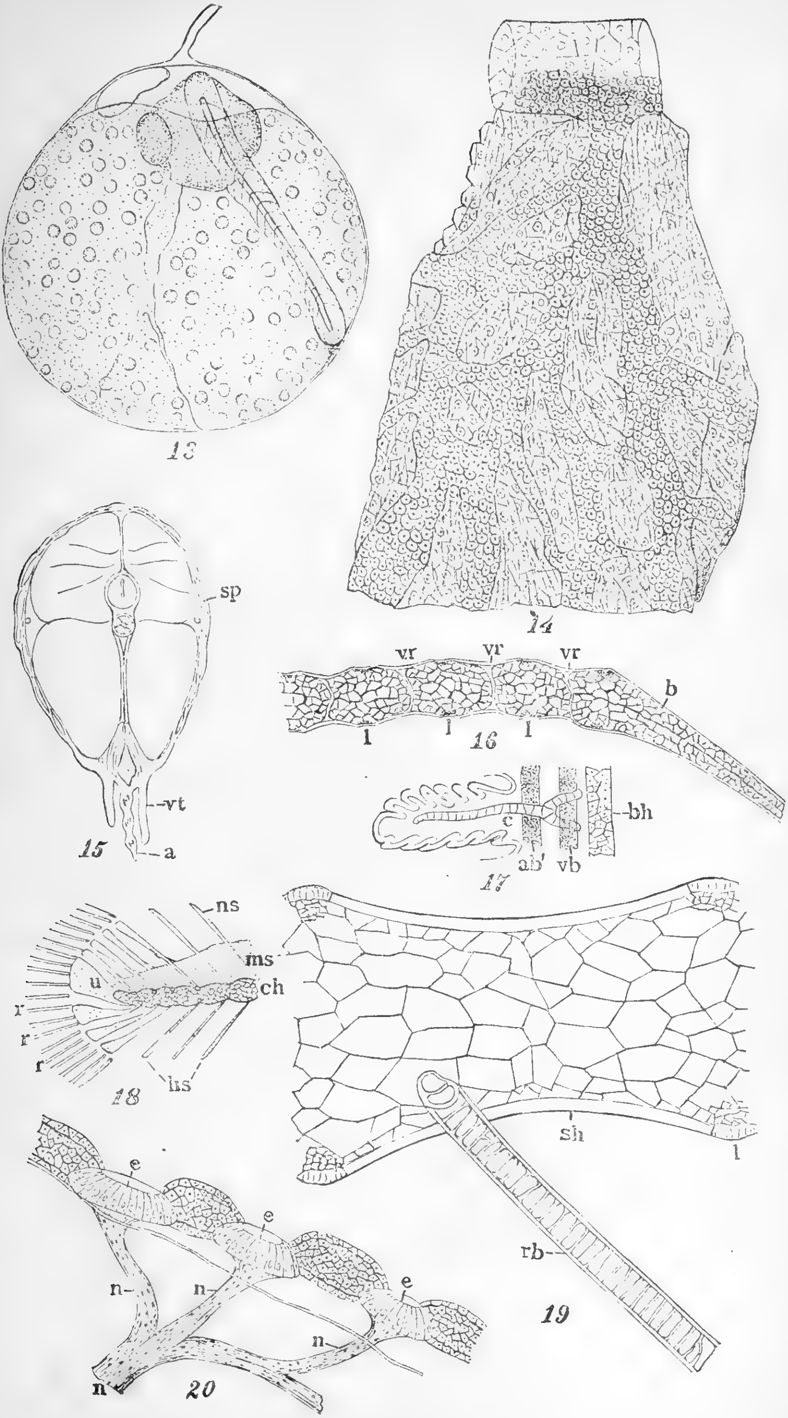
FIG. 17.—Longitudinal section through a branchial filament. x 183.

FIG. 18.—The tail of an advanced embryo, drawn from sections. x 35.

FIG. 19.—A vertebral segment and rib in place, from an advanced embryo. x 365.

FIG. 20.—Neuromasts with their nerves from a cross-section through the cheek of an advanced embryo. x 200.

PLATE IX.



DEVELOPMENT OF GAMBUSIA PATRUELIS.

EXPLANATION OF PLATE X.

REFERENCES: *ab*, air-bladder; *ao*, aorta; *Au*, auditory vesicle; *B. B*, basibranchial cartilages; *Br*, branchial bar; *Brs*, branchiosteges; *Cb*, cerebrum; *Cer*, cerebellum; *ch*, chorda; *Oh*, optic crus; *Chs*, chorda sheath; *Cor*, coracoid end of scapular arch; *d*, denticles; *df*, dental follicle; *Dm*, dermal muscle; *ep*, epithelium; *F*, cranial fontanelle; *Ghy*, glosso-hyal; *Hi*, hypophysial involution; *Hm*, Hyomandibular; *Hy*, hypophysis; *H. Hy*, Hypo-hyal; *i*, intestine; *I. H*, interhyal; *In*, infundibulum; *it*, *iter a tertio*; *m*, myotomic segments; *mb*, mid-brain; *me*, mesoblast; *mes*, mesentery; *Mk*, Meckel's cartilage; *ms*, medulla spinalis; *nc*, canalis centralis; *ns*, cartilaginous or fibro-cartilaginous neural arch; *o*, genital folds; *oep*, oral epithelium; *Oc*, occipital cartilage; *Or*, orbit; *Om*, ocular muscles; *pp*, peritoneal cavity; *pp'*, peritoneal or lymph cavity on either side of the air-bladder; *pi*, pigment layer; *Pch*, parachordal element; *pch*, perichondrium; *Pv*, Pons varolii; *Pn*, mesonephros; *pn*, pineal gland; *P. Pt*, palato-pterygoid; *Qu*, quadrate; *r'*, *r'*, rays; *rb*, cartilaginous axis of ribs; *rb'*, fibro-cartilaginous investment of ribs; *rao*, radix aorta; *s*, perichondrial tooth-sockets (cementum plates of pharynx); *Sc*, scapular part of shoulder girdle; *S. br*, supra-branchial elements; *Sk*, skeletogenous tract from which the vertebræ and arches develop; *ssv*, supra-spinal vessel; *sl*, deep layer of epidermis; *Sy*, symplectic; *Tr*, trabecula (anterior part); *T. cr*, tegmen cranii; *vc*, vena cardinales; *Wd*, Wolffian ducts.

FIG. 21.—Chondrocranium of advanced embryo of *Gambusia*. x 35.

FIG. 22.—Cross-section through chorda, medulla and incipient vertebræ of the tail. x 65.

FIG. 23.—Cross-section through an embryo of *Gambusia* just behind the occiput. x 65.

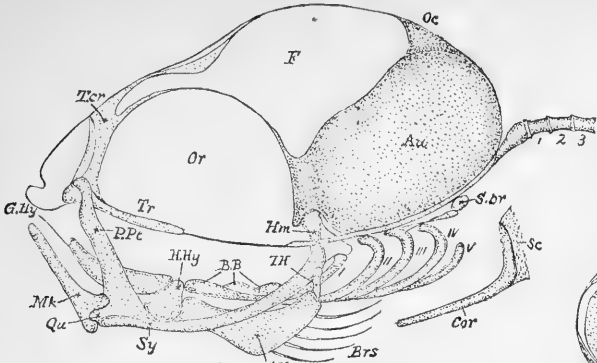
FIG. 24.—Cross-section through the tail of a similar embryo. x 365.

FIG. 25.—Cross-section through the posterior part of the air-bladder and adjacent organs of an embryo of *Gambusia*. x 96.

FIG. 26.—Section through a dental follicle and tooth from the pharyngeal region. x 365.

FIG. 27.—Section through a group of pharyngeal teeth and their supporting plates and branchial bar. x 365.

FIG. 28.—Median section through the brain of an advanced embryo of *Gambusia*. x 35.



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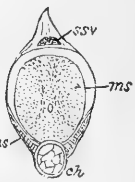

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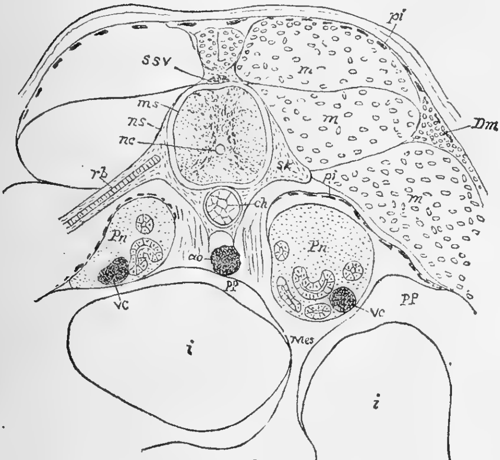

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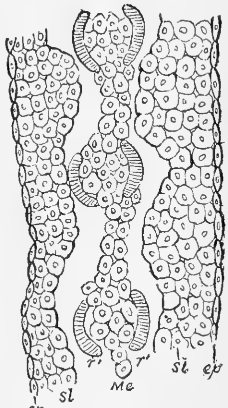

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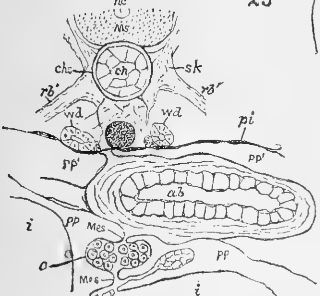

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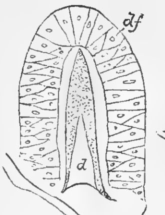

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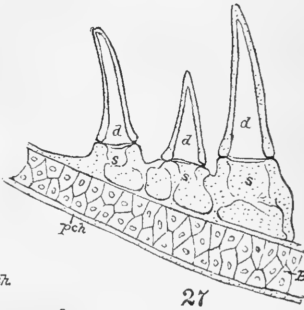

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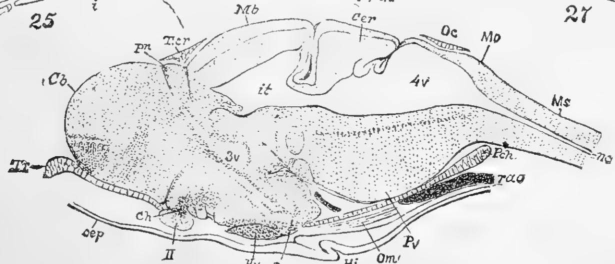

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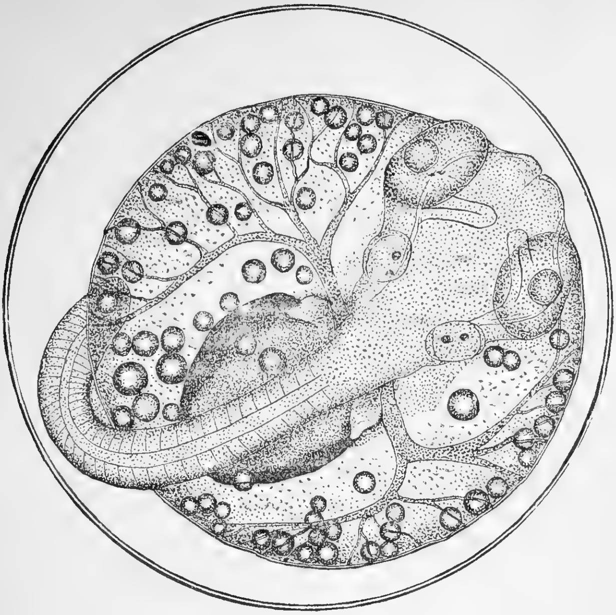
DEVELOPMENT OF GAMBUSIA PATRUELIS.

EXPLANATION OF PLATE XI.

FIG. 29.—Transparent view of a developing ovum of *Fundulus* forced from the ovary by pressing the abdomen of the living fish. x 32.

FIG. 30.—A similar view of another ovum of the same species; the embryo viewed from below and anteriorly, instead of from above, as was the preceding. x 32.



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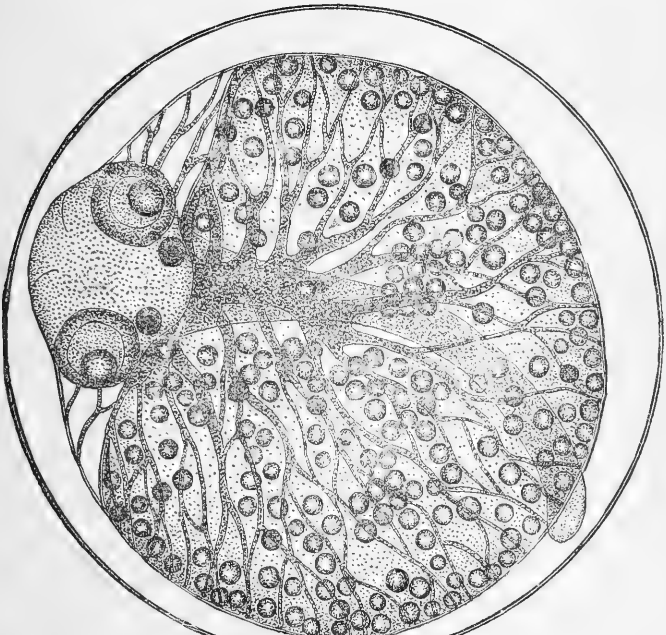

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DEVELOPMENT OF FUNDULUS.

EXPLANATION OF PLATE XII.

REFERENCES: *a*, anal lobe; *ao*, aorta; *c*, vitelline capillaries; *ca*, carotid; *cd*, caudal lobe; *cv*, cardinal or caudal vein; *ch*, chorda dorsalis; *d*, dorsal lobe; *ep*, epiblast of yelk-sac; *g*, goblet cells of epiblast; *h*, heart; *i*, intestine; *j*, jugular; *L*, liver; *ll*, lateral line; *m*, cut ends of dorsal halves of the muscular segments; *ms*, medulla spinalis; *n*, caudal notch; *o*, round spaces in sections of vitellus in which oil has been contained; *p*, periblast; *pe*, pectoral; *pv*, portal vessel, prëanal lobe; *r*, ribs, cut through obliquely in the section; *s*, segmental intermuscular vessels; *sc*, caudal sinus; *scl*, subclavian artery; *sd*, soft dorsal lobe; *si*, subintestinal vessel; *v*, vent; *vv* and *vv'*, vitelline veins; *vc*, venæ cardinales; *vm*, mesoblastic investment of vitellus; *vt*, ventral fin; *Wd*, Wolffian duct.

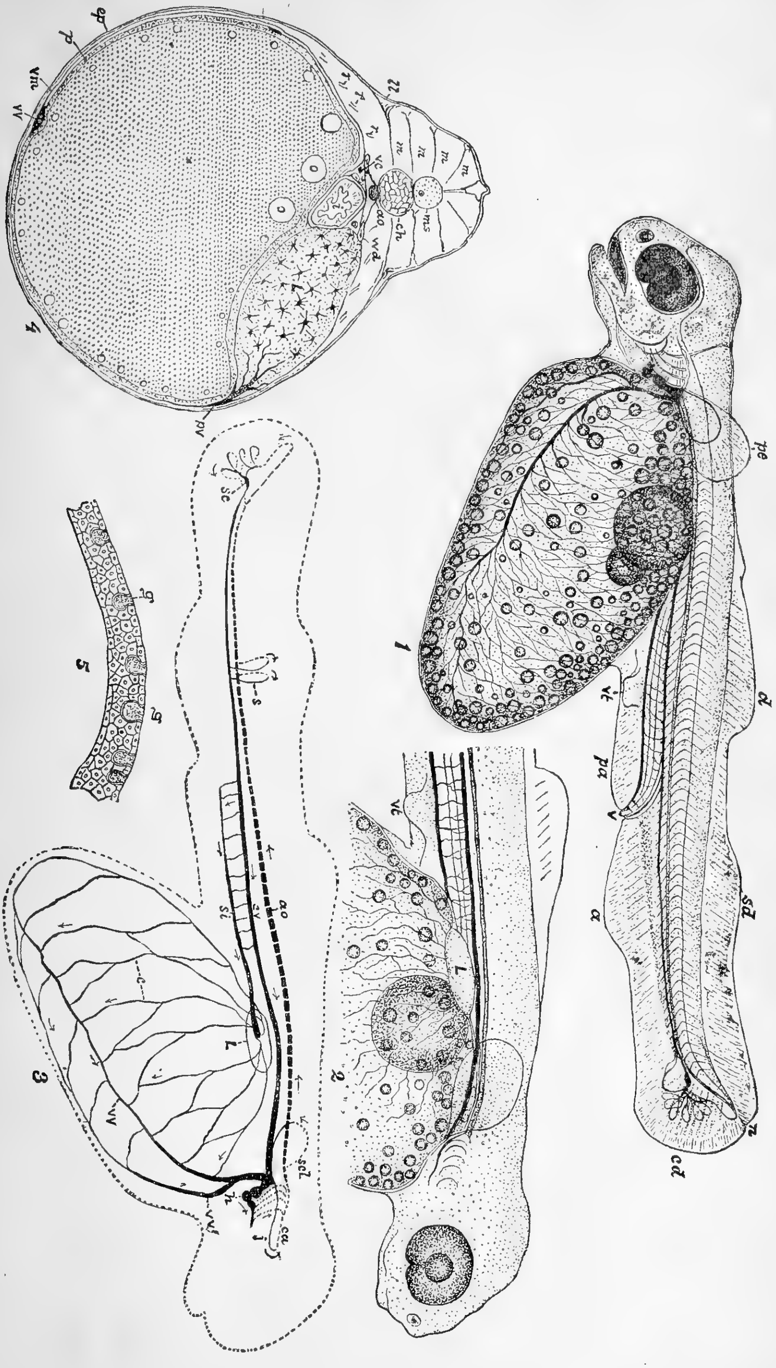
FIG. 1.—Recently hatched embryo of the Schoodic or landlocked salmon, viewed from the left side and figured from the living specimen. x 7 +.

FIG. 2.—Same viewed from the right side. x 7 +.

FIG. 3.—Diagram of the circulatory system of the young salmon.

FIG. 4.—Cross-section through the body and yelk of a young salmon, through the region of the liver. x 16.

FIG. 5.—Section through the epidermis of a salmon embryo to show the goblet cells *g*. x 200.

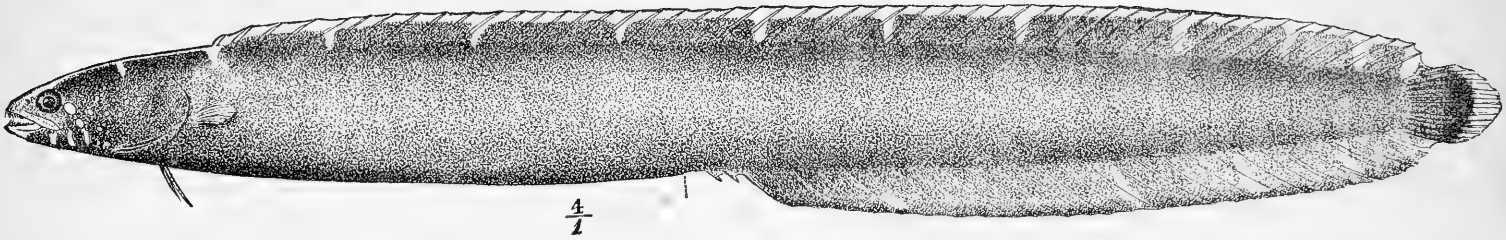


CERTAIN FEATURES OF THE DEVELOPMENT OF THE SALMON.

EXPLANATION OF PLATE XIII.

(For description see pages 191–192.)

Stathmonotus hemphillii Bean. Four times natural size.
Key West, Florida, Henry Hemphill.



STATHMONOTUS HEMPHILLII—4 TIMES NATURAL SIZE.
(Described on page 191.)

EXPLANATION OF PLATE XIV.

(For text see pages 209–213.)

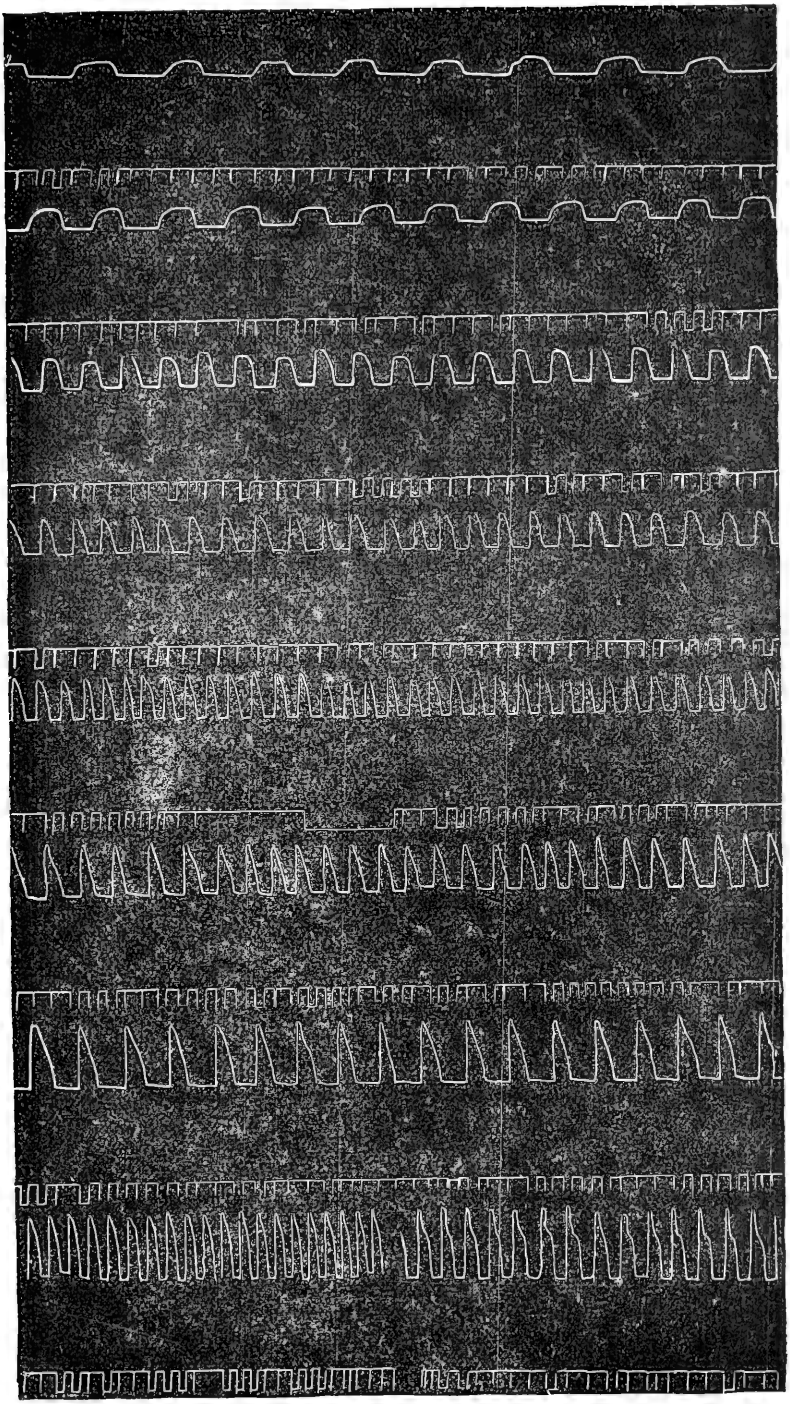
Amblystoma copeianum Hay. About natural size.

The type specimen was found at Irvington, Ind., by Mr. George H. Clarke.

AMBLYSTOMA COPEIANUM, HAY

EXPLANATION OF PLATE XV.

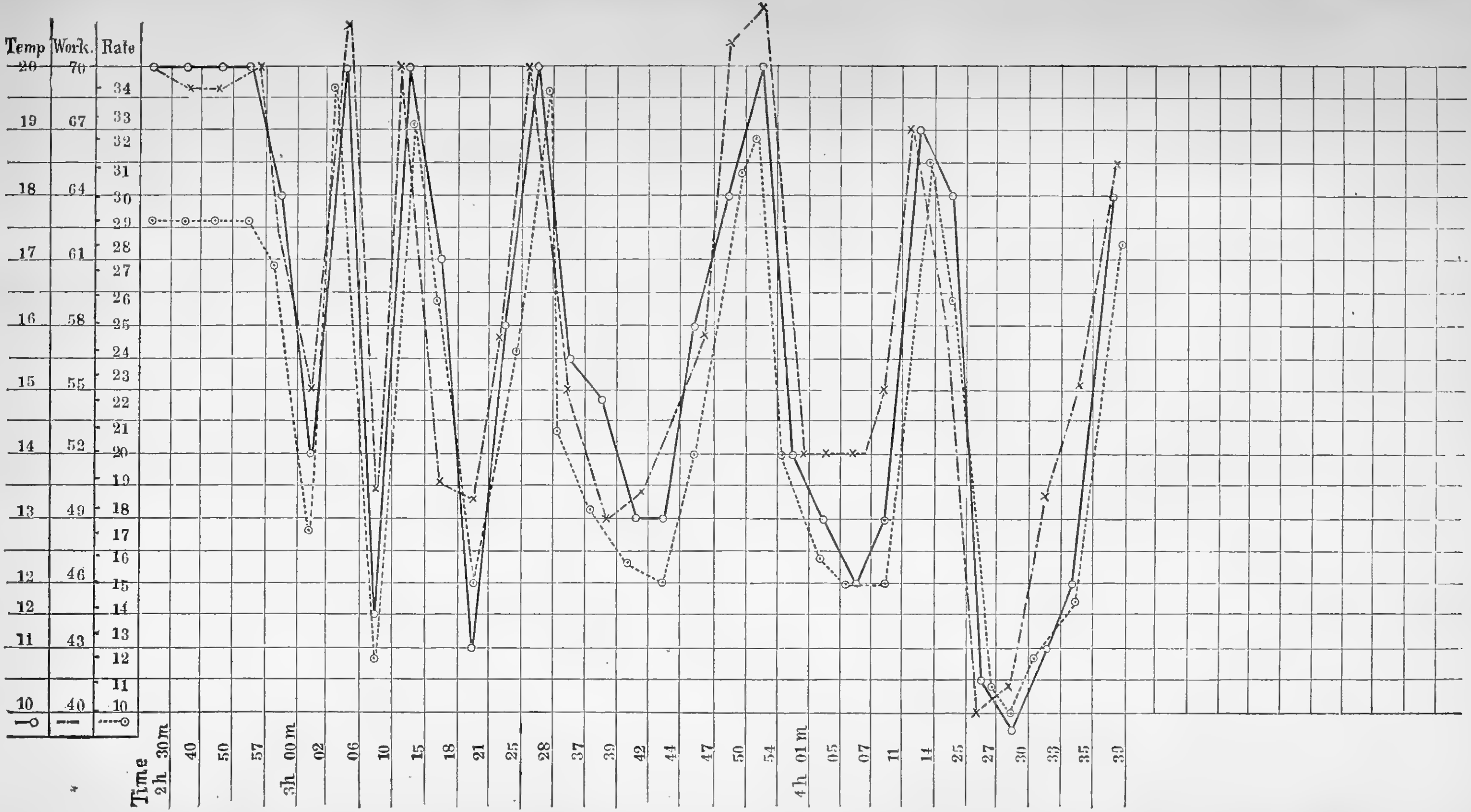
Tracings obtained from an isolated heart under the influence of different temperatures. The low, broad-topped curves on the upper part of the plate are produced by the lower temperatures and contrast very markedly with the long, sharp-pointed ones lower down, which were produced by higher temperatures.



EXPLANATION OF PLATE XVI.

Graphic representation of Experiment XXXI, which is described on page 229 of this volume.

PLATE XVI.

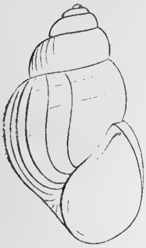


EXPERIMENT XXXI, MAY 4, 1885.

EXPLANATION OF PLATES.

PLATE 17.

FIG. 1. *Campeloma lima* Anthony. Florida.
FIG. 2. *Vivipara georgiana* Lea. Florida.
FIG. 3. *Vivipara georgiana* Lea. Florida.
FIG. 4. *Ampullaria depressa* Say. Florida.
FIG. 5. *Ampullaria depressa* Say, operculum.
FIG. 6. *Blauneria heteroclita* Montague. Florida.
FIG. 7. *Goniobasis Etowahensis* Lea. Florida.
FIG. 8. *Neritina reclivata* Say. Florida.
FIG. 9. *Bythinella monroensis* Dall. Florida.
FIG. 10. *Hydrobia wetherbyi* Dall. Florida.
FIG. 11. *Pupilla floridana* Dall. Florida.



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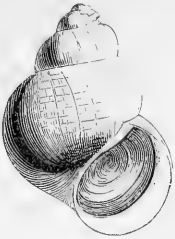

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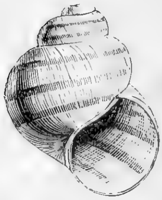

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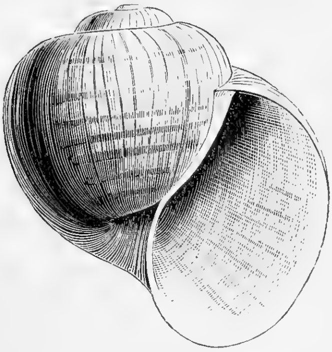

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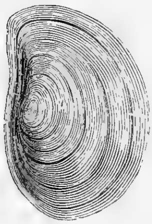

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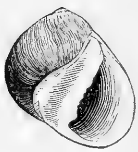

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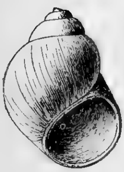

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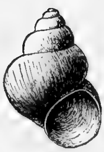

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FLORIDA SHELLS.

PLATE 18.

FIG. 1. *Melampus flavus* Gmelin. Florida.
FIG. 2. *Melampus floridanus* Shuttleworth. Florida.
FIG. 3. *Melampus coffeus* Linné. Florida.
FIG. 4. *Pedipes elongatus* Dall. Florida.
FIG. 5. *Tralia pusilla* Gmelin. Florida.
FIG. 6. *Pedipes unisulcatus* Cooper. West America.
FIG. 7. *Detracia bulloides* Montague. Florida.
FIG. 8. *Auriculastrum pellucens* Mke. Florida.
FIG. 9. *Melampus lineatus* Say, var. Florida.
FIG. 10. *Sayella crosseana* Dall. Florida.
FIG. 11. *Sayella Hemphillii* Dall. Florida.
FIG. 12. *Melampus lineatus* Say. Florida.
FIG. 13. *Leuconia bidentata* Montague. Florida.
FIG. 14. *Carychium exiguum* Say. United States.
FIG. 15. *Pedipes liratus* Binney. West America.
FIG. 16. *Melampus olivaceus* Carpenter. West America.
FIG. 17. *Pedipes naticoides*, Stearns, Florida.

PLATE XVIII.

FLORIDA SHELLS.

EXPLANATION OF PLATE XIX.

(Turbinella pyrum, Lamarck, p. 345–347.)

Fig. 1. Teeth, rachidian, and laterals.

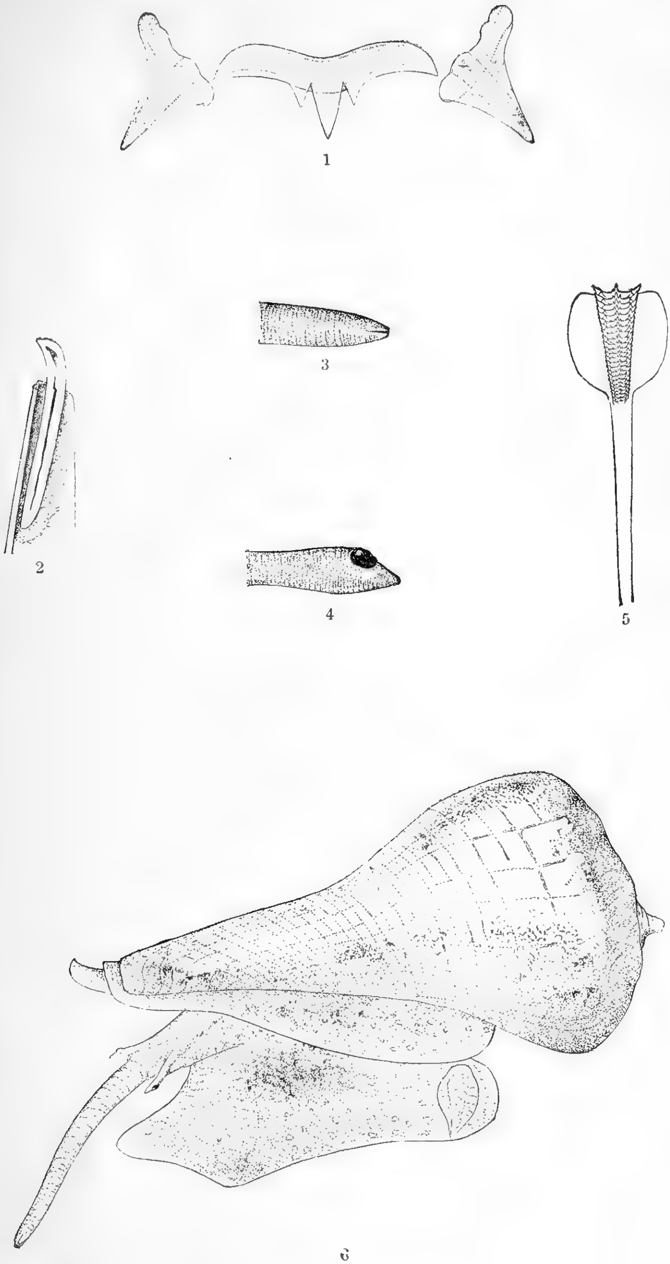
Fig. 2. End of siphonal fold, the right mantle edge cut away to show the internal fold; natural size.

Fig. 3. End of proboscis, from above; natural size.

Fig. 4. Extremity of left tentacle, as contracted in spirits, showing eye, enlarged.

Fig. 5. General form of radula, greatly magnified.

Fig. 6. Turbinella pyrum, Lam., crawling, one-half natural size. Restored from an alcoholic specimen.



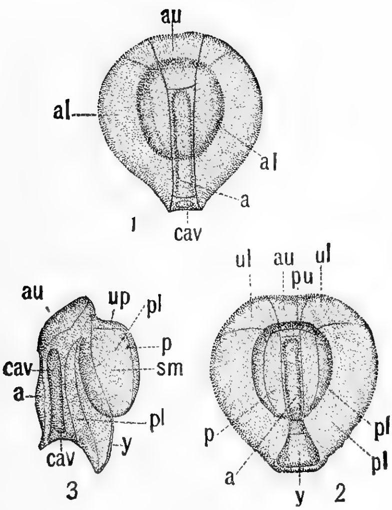
TURBINELLA PYRUM, LAMARCK.

EXPLANATION OF THE PLATE.

[Plate XX, this volume.]

a. Anterior plane of anterior face.
al. Antero-lateral plane.
au. Upper anterior plane.
cav. Cavity of nectocalyx.
p. Posterior plane of posterior face.
pl. Postero-lateral plane.
pu. Upper posterior plane.
sm. Somatocyst.
ul. Upper lateral plane on posterior side.
up. Upper posterior plane.
y. Recess into which fits the apical portion of posterior nectocalyx.

Fig. 1. Anterior nectocalyx seen from the anterior face.
Fig. 2. Anterior nectocalyx seen from the posterior face.
Fig. 3. Lateral view of the anterior nectocalyx.



ABYLA TRIGONA, QUOY & GAIMARD.

EXPLANATION OF PLATE XXI.

FIG. 1. Head of *Hesperomys Truei*, ♂, life size. From the specimen captured at Fort Wingate, N. Mex., March 16, 1885.

FIG. 2. Head of *Hesperomys leucopus sonoriensis*, ♂, life size. From the specimen taken at Fort Wingate, N. Mex., May 16, 1885.

FIG. 3. Head of *Ochetodon humilis*, ♀, life size. From the specimen taken at Fort Wingate, N. Mex., June 30, 1885.

FIG. 4. Superior aspect of the cranium of *Neotoma floridana*, ♂, natural size. Specimen taken at Fort Wingate, N. Mex., January 11, 1885.

n. mx. Nasal process of the superior maxilla.

FIG. 5. Superior aspect of the cranium of *Hesperomys Truei*, ♂, natural size. Type specimen.

n. mx'. Nasal process of the superior maxilla.

FIG. 6. Left lateral view of mandible of *Neotoma floridana*, natural size. Same specimen as Fig. 4.

FIG. 7. Left lateral view of mandible of *Hesperomys leucopus*, natural size. Specimen 4856, National Museum Collection.

FIG. 8. Left lateral view of mandible of *Hesperomys Truei*, natural size. Same specimen as Fig. 5.

(All the figures drawn from nature by the author.)

Fig. 2.

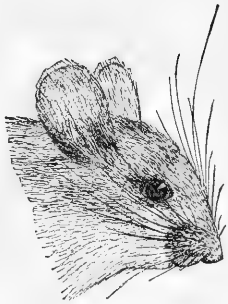


Fig. 3.

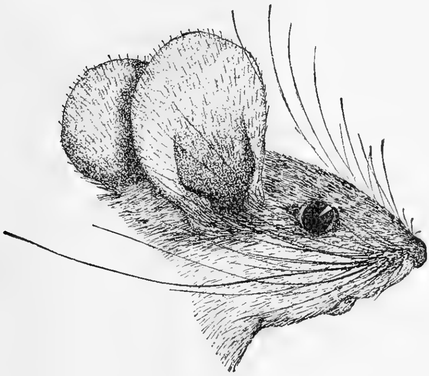


Fig. 1.

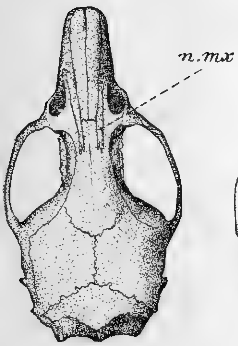


Fig. 4.

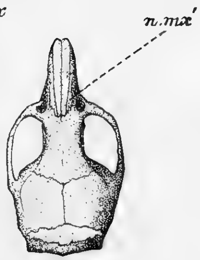


Fig. 5.

Fig. 7.

Fig. 8.

Fig. 6.

EXPLANATION OF PLATE XXII.

FIG. 1. Front view of the Chaclacayo skull, showing the complex trephine, the mummified skin still adhering to the bone, the cranial deformation, and the distorted condition of the bones of the nose.

FIG. 2. Shaded view of the artificial opening enlarged, showing direction of incisions.

FIG. 3. Outline of artificial opening, with a slight difference in the interpretation of shallow scratches in the upper right-hand portion.

PLATE XXII.

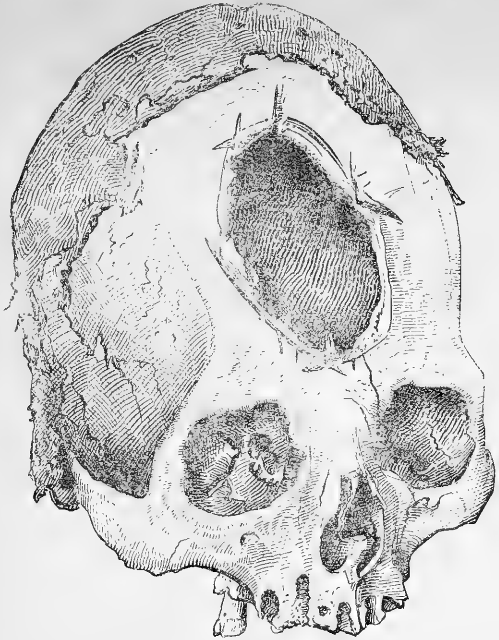


FIG. 1.

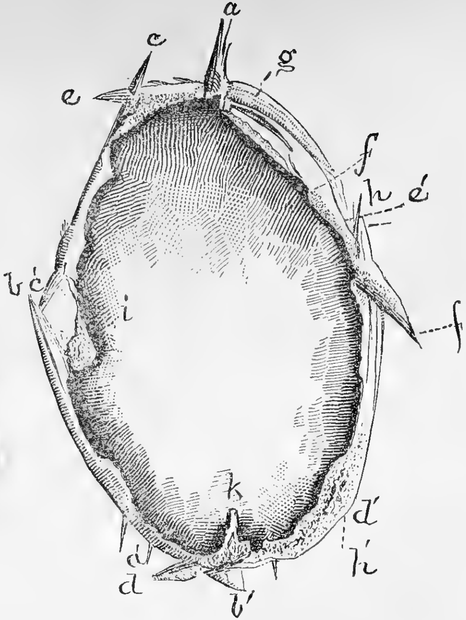


FIG. 2.

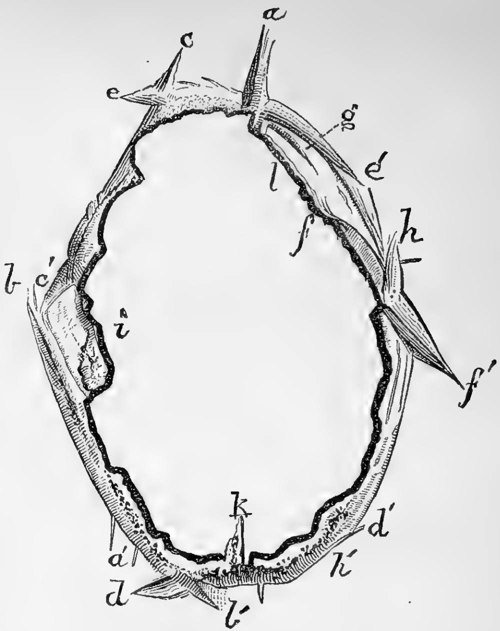


FIG. 3.

THE CHACLACAYO TREPHINED SKULL.

EXPLANATION OF PLATE XXIII.

FIG. 1.—*Merisus destructor*, ♀.

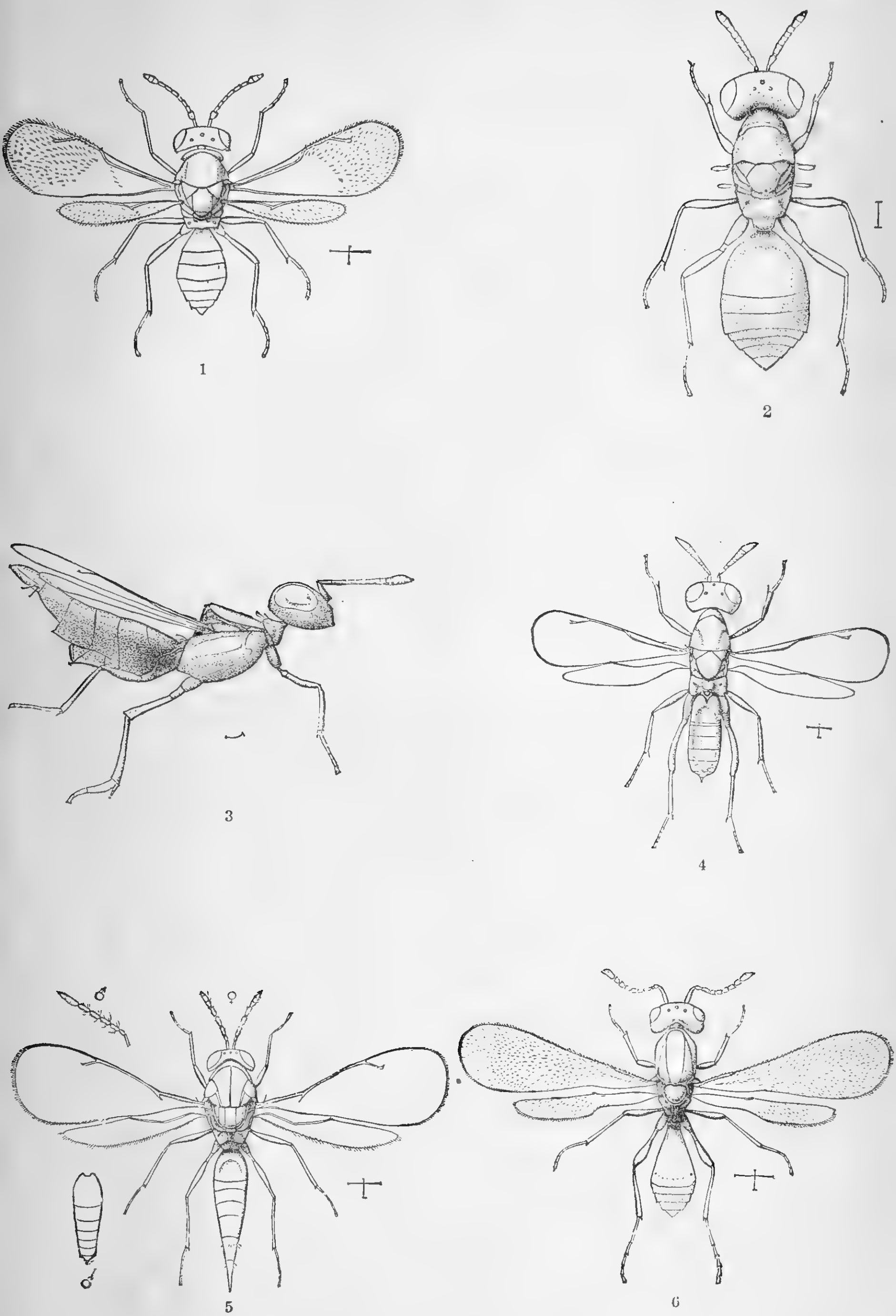
FIG. 2.—*Merisus subapterus*, ♀.

FIG. 3.—*Eupelmus allynii*, ♀.

FIG. 4.—*Eupelmus allynii*, ♂.

FIG. 5.—*Tetrastichus productus*, ♀.

FIG. 6.—*Platygaster herrickii*, ♂.



HESSIAN FLY PARASITES.

EXPLANATION OF PLATE XXIV.

SAN DIEGO SHELLS.

FIG. 1. *Lamellaria diegoënsis* Dall, profile; p. 538.
FIG. 2. *Lamellaria diegoënsis* Dall, from above; p. 538.
FIG. 3. *Lamellaria diegoënsis* Dall, from below; p. 538.
FIG. 4. *Milneria minima* Dall, ♂, magnified profile; p. 549.
FIG. 5. *Milneria minima* Dall, ♀, from below, showing marsupium empty; p. 549.
FIG. 6. *Milneria minima* Dall, ♂, from below, showing base without marsupium; p. 549.
FIG. 7. *Milneria minima* Dall, ♀, from below, showing marsupium covered by mantle tissues; p. 549.
FIG. 8. *Thecalia concamerata* (Chemn.) H. & A. Adams, from Cape of Good Hope; magnified view of interior of ♀ shell, showing completed marsupium in right valve; p. 550.

PLATE XXIV.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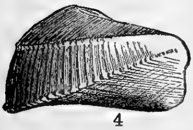
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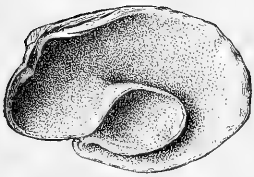
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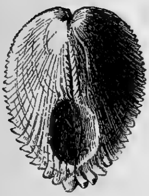
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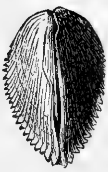
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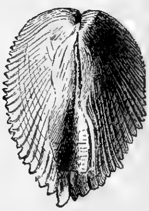
7

SAN DIEGO SHELLS.

EXPLANATION OF PLATE XXV.

(For description see pp. 584–585.)

Fig. 1. Skull of *Mesoplodon Stejnegeri*, True. View from above.
Fig. 2. Lateral view of the same skull.
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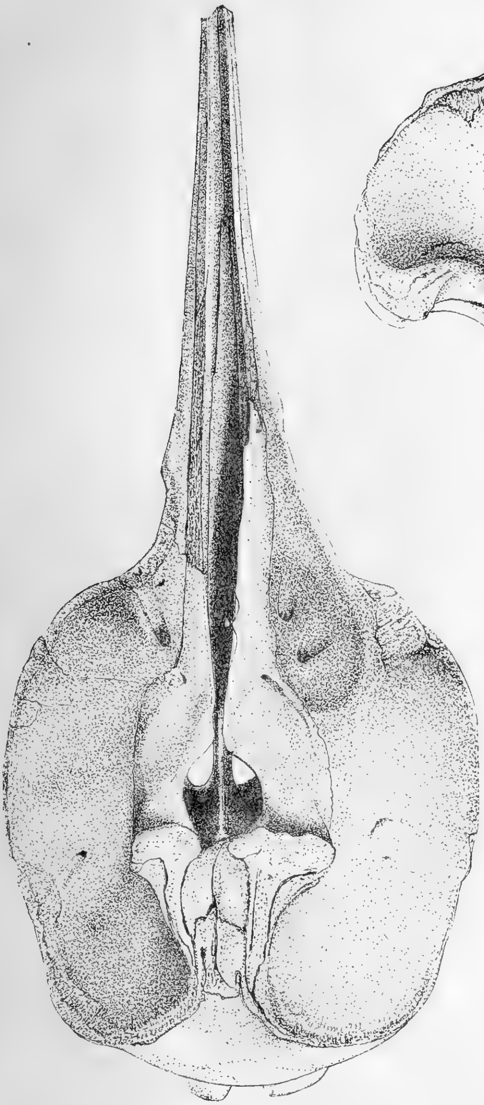

FIG. 1.

FIG. 2.

MESOPLODON STEJNEGERI, TRUE.